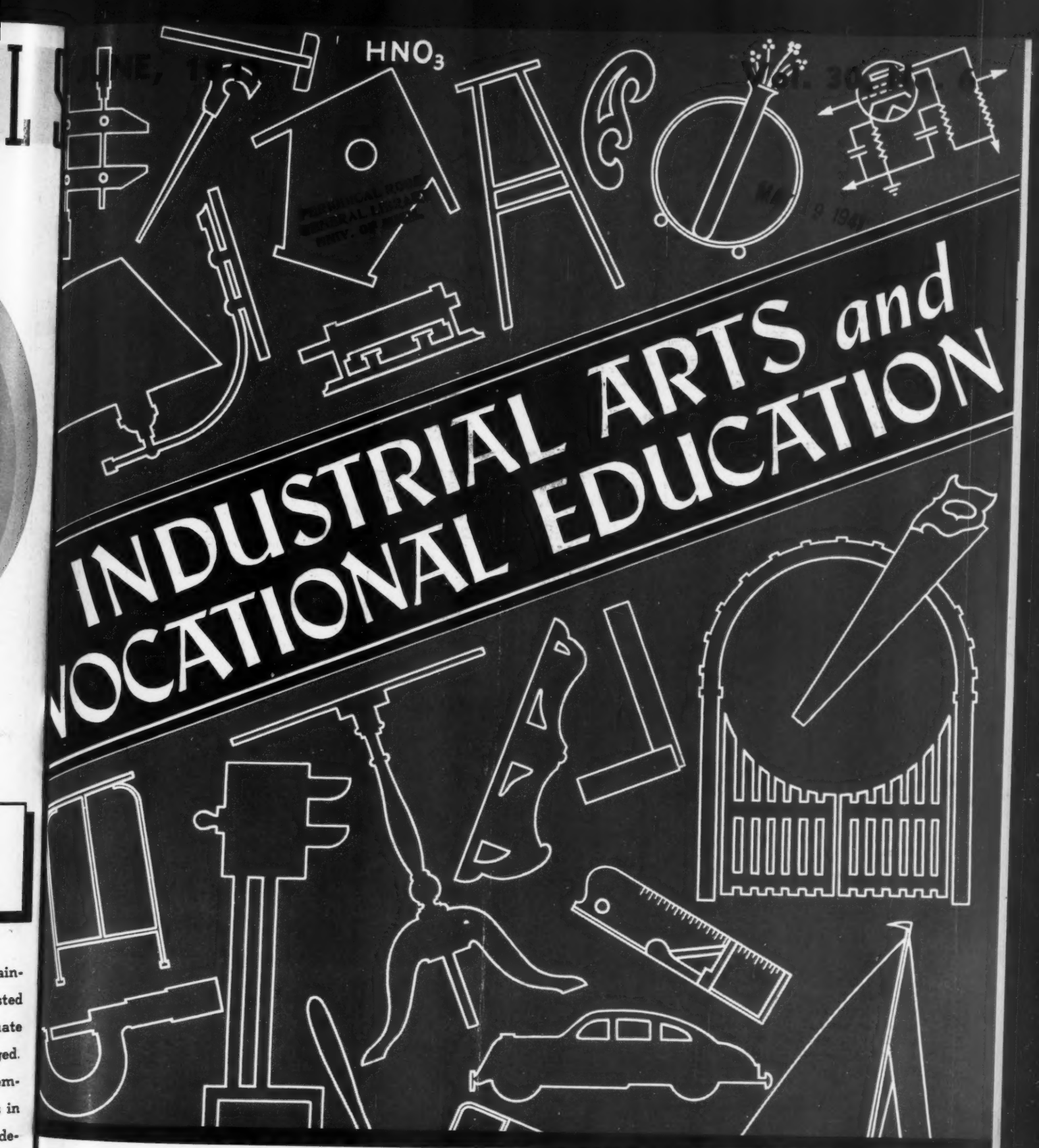

In This Issue: **Planning and Equipping a Graphic-Arts Shop**

By Roy R. Van Duzee and Raymond W. Sturm

SAW FILING, TOO, IS AN "ART"!

"You never saw a saw file file a saw like this file files saws"—so goes the old tongue-twisting saw. And you'll probably say there's "more truth than twistin' " in it after you've seen and felt a Nicholson or Black Diamond Slim Taper file sing its way across a saw-tooth with the silken-smooth "bite" of a fiddler's bow!

But, let's continue with our lesson: HAND-SAW FILING.

Two operations are required to make saws cut efficiently. The first is the *set*, which points the teeth at the proper angle with relation to each other and makes the cut wider than the blade itself. The second is the *sharpening* of the teeth, which is done with a file. In certain types of saws which have no set, only filing is necessary to keep them cutting properly.

Fig. 2

Holding the saw. Some provision must be made for holding the saw while it is being filed. The best equipment for this purpose is the saw vise (Fig. 1), which can be purchased in the hardware store. But lacking this, a satisfactory clamp may be made of wood, to be held in a bench vise.

The first steps. Hand-saws are of two types—Cross-cut and Rip. Both require setting before sharpening if they have been used for some time. In general, however, four or five sharpenings may be made before setting is required.

Before the teeth are set, the first step is to make sure that their top edges are at an equal height. This is done by jointing, or passing a file lightly, lengthwise, along the tops of the teeth (Fig. 2). After this is finished it will be noted that some of the teeth have been flattened on top while others have been barely touched. Obviously, the former require the most filing.

For the average user, the most satisfactory way of setting the saw is with the Saw-set—a hardware-store item made for the purpose. This tool is used to bend the teeth slightly—and uniformly—so that the width of the cut will be wider than the blade itself (Fig. 3). This keeps the saw from "binding." Note that alternate teeth are bent in opposite directions on both Cross-cut and Rip saws to about half the thickness of the tooth. The set should bend only the top half of the tooth, otherwise the tooth may break off.

HAND CROSS-CUT SAW

HAND RIP-SAW

Fig. 3

Filing the Hand Cross-cut saw. The teeth of this saw (Figs. 3 and 4) cut with both edge and point. Consequently, edges must be bevel-sharpened. The filer should begin at the point of the saw and work toward the handle. These Nicholson or Black Diamond files are recommended for Cross-cut saws:

For 5 to 7 points per inch—
6″ or 7″ Slim Taper file.
For 8 or 9 points per inch—
7″ Extra Slim Taper file.
For 10 and 11 points per inch—
4″ to 5½″ Extra Slim Tapers.

HAND CROSS-CUT SAW

HAND RIP-SAW

Fig. 4

Fig. 1

Place the file in the gullet to the left of the first tooth set away from you. Hold the file level, at the angle with the saw blade indicated in Fig. 1. At this angle, it should touch evenly on the bevels of two teeth and rest firmly in the gullet. ***Keep the file level throughout the stroke.*** Don't "rock" it. If jointing has left some flat tops, these teeth should be filed until *half* the flat tops have been cut away. Skip the next gullet—and every other one thereafter—and proceed as before. Then reverse the saw in the vise or clamp, and again begin at the point end of the saw, filing in the gullets not touched on the first "trip." File until all flat tooth tops are brought to a fine, sharp point.

Filing the Hand Rip-saw. Follow the same procedure as with the Cross-cut saw, so far as jointing and choice of file are concerned. Note, however (Fig. 3), that the Rip saw is filed so its tooth points, not its tooth edges, do the cutting. In this case the file is held level and *at right angles* to the side of the saw-blade (Fig 5). File the teeth (every other tooth) that are set away from you, then reverse the saw in the vise or clamp and repeat the operation.

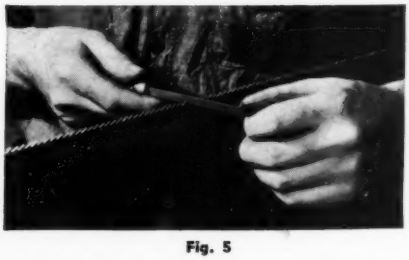

Fig. 5

And this isn't all! What about filing two-men Cross-cut, Circular, Buck, Butcher and other kinds of saws? The Nicholson 28-page book, "*A File for Every Purpose,*" tells about these too—and about a lot of other things concerning files and filing. It's FREE *to Instructors and Students.* Address—

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Nicholson and Black Diamond files for every purpose are available through good hardware and mill-supply houses.

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

VOL. 30 JUNE, 1941 Number 6

VACATION DAYS

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION wishes its many readers a thoroughly enjoyable vacation.

To those who are still undecided as to which summer school to choose, we wish to call attention to the list which appeared on the Table of Contents page in the May, 1941, issue of our magazine. Summer school, no doubt, entails much work, but this work also is accompanied by many compensating pleasures and enjoyments.

To those who are planning to tour our beautiful country, or to fish its oceans, lakes, and rivers, we wish fine scenery, good roads, enjoyable weather, and — big catches.

To those who are going to spend the greater part of the summer in teaching, either at teacher-training institutions or in national defense classes, we wish success with their work, but also opportunities to plan some kind of concentrated vacation program so that they, too, will be able to rebuild their strength to carry on in the coming school year which, from all indications, will require extraordinary efforts from all teachers of industrial arts and vocational education.

COMING CONVENTIONS

The following conventions have been scheduled for the vacation period:

PENNSYLVANIA VOCATIONAL ASSOCIATION, Eagles Mere, Pa., June 25–27.

NATIONAL GRAPHIC ARTS EDUCATION ASSOCIATION, Cleveland, Ohio, June 29–July 2.

AMERICAN INDUSTRIAL-ARTS ASSOCIATION in connection with the National Education Association, Statler Hotel, Boston, Mass., June 29–July 3.

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Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

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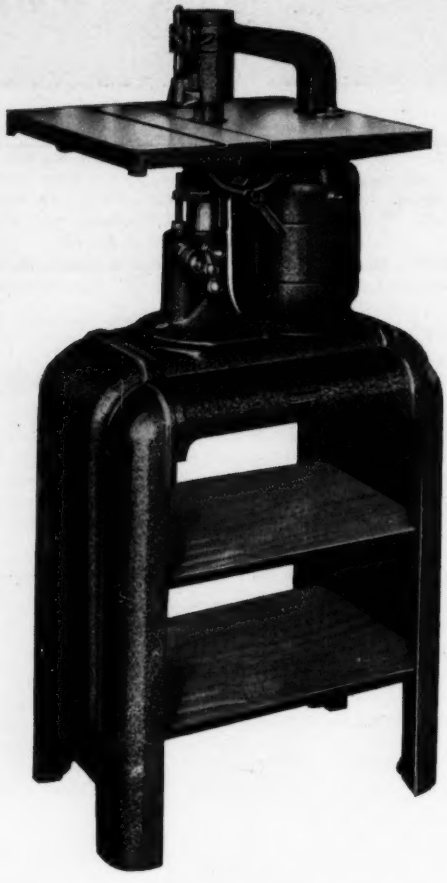

W-110 SHAPER

It's easy for shop students to concentrate on their work when using Yates-American machines. Efficient design, sturdy construction, perfect guarding and ease of operation give complete freedom from distraction, and permit the operator to focus all his attention on the job at hand.

This is illustrated on the W-110 Shaper. A completely enclosed drive, utilizing a flat fabric belt, greatly minimizes objectionable noise and vibration. The nickel-alloy, cast-iron table is ground to an exceedingly smooth finish to permit free movement of the stock. All moving parts are fully guarded to avoid the possibility of mental strain on the operator. Also every effort has been made to simplify the operation and adjustment of this shaper. To facilitate certain operations a tilting table is available.

These are only a few of the many fine features on this machine but they do serve to prove our point that Yates-American machines do make possible greater concentration, one of the primary essentials for instruction of any kind.

Why not have us send you complete information about this machine or any of our many types and models intended for school use. Let us know of your requirements.

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Short Talks on Wood

BLACK GUM (*Nyssa sylvatica*)

Sometimes known as Sour Gum. Often wrongly called Tupelo because of a close similarity between the two woods. The two species, however, are distinctly different. The wood is very tough, heavy and fine-grained. Interlocked grain makes it difficult to split and work. Modern treating processes have overcome its tendency to warp and decay. Light brown in color.

Its uses are gradually becoming more diverse as its good qualities are getting better known. Most of the cut is made into boxes and crates, and furniture. Also used for rollers, mallets, pulpwood and heavy-duty floors.

Found from Maine to Florida, west to Michigan and Texas. Finds footing in many types of soil and different conditions of soil moisture. Grows thinly scattered in the forest, seldom in clear stands.

A medium-sized tree which may attain a height from 25 to 50 feet and a diameter from 1 to 2 feet. Its branches tend to grow straight out from the trunk, the lower ones often drooping. The head varies in form and is usually picturesque.

The bark on young trees is smooth to scaly. It breaks into square, reddish-brown to black blocks on older trees. The leaves are oval, simple, alternate, entire and from 2 to 5 inches long. Dark green and lustrous in summer, turning to a flaming red in fall. Bears dark blue, fleshy berries about ½" long in clusters of two or three on long, thin stems.

To date, twenty-six brief articles similar to the one above and dealing with the more commonly used woods have appeared in these ads. As in the past, we continue to invite your suggestions as to the species of wood you would like featured in this series.

YATES-AMERICAN

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

Planning and Equipping a Graphic-Arts Shop

ROY R. VAN DUZEE* and RAYMOND W. STURM**

This article is a discussion of the problems encountered in the planning, selection, purchase, and use of equipment for a graphic-arts shop. These problems deal with the following:

1. The basic philosophy underlying the whole industrial-arts curriculum.
2. Situations which necessitate a revision or expansion of equipment lists for existing programs.
3. Criteria used as guides, both for the selection of subject matter content, and for the selection of the proper equipment.
4. The function of a graphic-arts shop in its relation to the whole industrial-arts curriculum.
5. Specific units to be included in the courses offered in the graphic-arts shop, and methods used in teaching them.
6. How the selected equipment functions in carrying out the aims and purposes of the industrial-arts curriculum.
7. What experience has shown to be desirable in making shop plans and equipment proposals.

Shops are planned and equipped according to needs as expressed in the educational philosophy to which the school subscribes, the courses that are offered, what is taught in these courses, and how the work is taught. The type and amount of equipment purchased, and the facilities provided, depend a great deal on how the industrial-arts work is held in the community and, to a less extent, on the ability of the community to support the work.

The general idea behind industrial arts in West Allis is that industrial-arts work contributes something to the life of boys and girls which is not gained in any other schoolwork. In the elementary school industrial arts is used to interpret and vitalize the instructional content. In the junior high school level industrial arts is offered for general development, to enable a student to understand and interpret his surroundings so that he can adjust himself better to his environment. It is offered also to discover interests and abilities in industrial activities. The courses offered in the junior high school are those which involve the basic materials, tools, and processes of our modern civilization, namely: 7B, Duplicating; 7A, General Drawing; 8B, General Woodwork; 8A, General Electricity; 9B and 9A, General Metal. The work in the seventh and eighth grades is required. The ninth-grade work is elective. Time schedule: 5 periods per week, 55 minutes per day, 19-week semester. For those boys who have had no previous shopwork before electing ninth-grade work provision is made for them to take a course in "general shop" consisting of nine weeks of drawing, nine weeks of woodwork, nine weeks of electrical work, and nine weeks of general metalwork.

In the senior high school the industrial-arts work offers opportunities to: (1) continue experience in industrial activities which will help in the understanding of mechanical principles and devices of the modern environment; (2) develop skill and understanding in the use of tools, machines, processes, materials, and constructions used about the home and in industry; (3) promote good design and workmanship; (4) provide experience in the use of the graphic language of industry and construction activities; (5) acquaint the student with the background and development in materials and in ways of making things needed to sustain and enjoy life; and (6) provide experiences in construction of various types.

The work in the junior high school has been very broad, and not intensive. In the senior high school it is assumed that the student has determined for himself the courses he wishes to select from among the offerings of the senior high school. Specialization so far as industrial arts is concerned, means that the student restricts his work to studying more widely in one field of work and in fields allied to it. Each student has a purpose in electing a shop course. It has been found that the following purpose classifications cover a great majority of boys who elect shopwork; the boy who: (1) wishes to get a job in industry upon leaving school; (2) desires to apprentice himself in a certain trade; (3) wishes to become a teacher of shopwork; (4) wants shopwork in high school as a preparation for a technical course in the university; (5) wishes to develop manual dexterity as a prerequisite to dentistry or surgery; (6) takes shopwork for general education; or (7) elects shopwork to develop a hobby.

To satisfy the objective of industrial arts and the purpose classifications of students who wish to elect shopwork, the courses are offered in the grades listed:

10B and A grades: drafting, printing, woodwork, auto mechanics, machine shop, and electrical work.

11B and A grades: drafting, printing, auto mechanics, and machine shop.

12B and A grades: drafting and pattern-making.

Either ninth-grade general metal, ninth-grade general shop, or tenth-grade machine shop, must have been taken before electing 10B auto mechanics.

All courses are scheduled for two 50-minute periods per day, five days per week for a 19-week semester. Full credit is allowed for this work, and since two periods are given over to the course each day, no outside work is required. A minor consisting of two years of work, or a major consisting of three years of work, may be elected for graduation from the high school. Courses may be selected from several fields or concentrated in one, in accordance with the needs and desires of the student.

It frequently happens in growing cities that building programs must be altered to fit conditions which develop in directions not foreseen in the original plans. This

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**Instructor of Printing, Thomas Jones High School, West Allis, Wis.

happened in West Allis. In 1934 the first unit of a junior high school was built and equipped. Two general shops were included in the original layout. One shop was equipped for 7B duplicating, 7A drafting, and 8B woodwork. The other shop provided for 8A general electricity, and 9B and 9A general metalwork. The rapid increase in the enrollment in the senior high school made it imperative that additional housing and facilities be provided at the senior high school level. Since the anticipated population growth in the Nathan Hale Junior High School area did not develop, it was decided to change the school from a three-year junior high to a six-year junior-senior high school. It was believed that the junior-senior high school enrollment in the fall of 1940 would be 750 students. On this basis additional shop space would have to be provided. Since the general woodshop would accommodate woodwork, elementary drawing, and electrical work; and the general metal shop was equipped so that it would accommodate general metal and electrical work, it was decided to equip the third shop for the graphic arts. Checking back through the course of study offered, it will be noted that all activities in the junior-senior high school industrial-arts courses were provided for except auto-mechanics work. It was agreed that no provision could be made for auto mechanics until an additional shop was provided at this school.

It might be well to go into some detail at this time to set forth the reasons why the graphic arts were to be offered, to list the activities and units to be taught, and to explain the scope of the work. This explanation is the justification for the selection of the courses and furnishes guides to the selection of the equipment and its placement in the shop.

Justification for Including the Graphic Arts

What are the graphic arts? One commonly accepted definition is as follows: "Those fine arts and processes which pertain to the representation of objects on a flat surface, such as printing, engraving, lithography, painting, and drawing."

It would appear that printing and drawing comprise a large portion of the area involved. Regarding the scope and significance of the graphic arts, printing with its allied crafts is considered the sixth ranking industry in the United States. It is the oldest of the large industries, and is one whose products are used by every other industry, trade, and profession. Printing has an unlimited field of usefulness, and has done more to promote civilization than any other material factor.

"The ability to represent ideas readily by means of drawing is a success factor in many occupations, such as mechanic, artisan, builder, engineer, statistician, teacher, landscape gardener, interior decorator, sales engineer, etc. Not only do many individuals find drawing useful in their vocation, but in this present-day highly technological civilization we often find that the written or spoken word is inadequate to express many ideas fully, and drawing must be used to convey the full meaning. Man has used words, signs, pictures, and drawings to express ideas from earliest times. As the things he made became more complicated, the need for drawing as a medium of thought and expression increased. The early part of the nineteenth century marked a change from simple articles of use to more complicated devices, as the steam engine, reaper, sewing machine, cotton gin, and rotary printing press were all built before 1850. With these complicated devices came a need for expressing more *exact* ideas of construction, operation, process, maintainance, and the like. Drawing was developed as a matter of need and has increased in importance. It has now reached a place of *general use*, to a point where it now becomes more and more important for everyone to express ideas by means of drawings."[1]

Taken as a whole, the graphic arts comprise one of the largest areas of human endeavor. Its scope and significance are such that makes it an area in which all students should have basic experiences.

There are many attributes which any body of subject matter should possess in order to warrant its inclusion in a high school curriculum.

Ericson[2] has published one such list which includes such attributes as the following:

"1. Does the type of work proposed represent a broad and typical industry?

"2. Is it rich in educational content?

"3. Does the subject lend itself to school procedure?"

Ashley[3] has also published such a list. Among other items, his list includes the following:

"1. Is it leading on or expanding the horizon of the children's experience?

"2. Will it provide materials for research?

"3. Will it be a social influence as well as an influence toward wholesome personal integration?"

These criteria, as well as others such as economy and availability, should be considered in the choice of the particular units to be selected from the total represented in the graphic-arts field.

The drawing courses to be offered in the graphic-arts shop under consideration are not materially different from the traditional courses in mechanical drawing. Recognition is being taken of the fact that drawing as generally taught, is too traditional in character, and that more attention should be paid to the selection of drawing content from *life-situation* sources.

The content of printing, especially in junior high school, is subject to special investigation. There is no significant agreement as to which particular graphic-arts units should be included in the printing courses. At the nineteenth annual conference on printing education in Rochester, N. Y., during the summer of 1940, the trend in graphic-arts courses was indicated in the following excerpt of the convention written by R. R. Karch:[4]

" . . . The group wishes to go on record as stating that in the junior high school the traditional course in printing should be enlarged in scope in order that it may take in the richer field of graphic arts, so that our philosophy of general education may be justified. The following outline may serve as a major breakdown or suggestion for the course in junior high school graphic arts:

"1. Letterpress printing
"2. Intaglio printing
  a) Etching
  b) Engraving
  c) Dry point
"3. Planographic printing
  a) Stone lithography
  b) Offset lithography
  c) Collotype
"4. Relief Platemaking
  a) Line engraving
  b) Linoleum engraving
  c) Wood engraving
  d) Wood cuts
"5. Papermaking
"6. Inkmaking
"7. Bookbinding
"8. Miscellaneous
  a) Silk screen printing
  b) Duplicating."

The junior high school printing course, offered in the shop described herein, includes other graphic-arts units besides letterpress printing.

The specific courses offered in the graphic-arts shop are 7B duplicating; 7A drawing; tenth-, eleventh-, and twelfth-grade drawing; and tenth- and eleventh-grade printing.

Junior High School Duplicating

Purposes: 7B duplicating has for its purpose: to acquaint the student with modern methods of reproducing and duplicating copy through the use of typical and representative graphic-arts activities which can advantageously be offered at this level.

Content: The units offered and studied are: letterpress printing, manuscript writing, typewriting, pantographing, stencil duplicating, decorative stenciling, printing with rubber (stamps and plates), gelatin duplicating, direct duplicating, multigraphing, block printing, photography, blueprinting, photoengraving, planographic printing, simple binding, and silk-screen printing.

---

[1] "Wisconsin Industrial Arts." Source Material Guides for Course of Study Planning. Drawing-Progress Report. Wisconsin Industrial Arts Association, Nov., 1940, page 10.

[2] Ericson, E. E., *Teaching Problems in Industrial Arts* (Peoria: Manual Arts Press, 1930), pp. 312–315.

[3] Ashley, Lawrence F., "This Thing Called 'Method' II," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 27 (April, 1938), p. 135.

[4] Karch, R. R., "Printing Teachers Give Views in Symposia," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 29 (Oct., 1940), pp. 343–344.

Senior High School Printing

Purposes: (1) To acquaint the student with an industry which ranks near the top of all industrial pursuits in the United States, (2) to acquaint the student with printed and duplicated forms, (3) to develop the ability to judge the quality and usefulness of printed materials used in everyday life, and (4) to develop valuable basic industrial skills in the printing crafts. These purposes include printing in its vocational aspects, and in its relation to general educational values.

Content: Tenth-grade printing acquaints the student with the problems, processes, and products in the field of printing. It includes the planning and setting up of the typical and representative printed material used in business and industry. Students learn how to select and calculate the amount of paper stock needed for printed jobs, to operate the paper cutter, to lock up forms for the press, and to operate and care for a platen press. Other units in tenth-grade printing include linoleum block printing, book repairing, pamphlet binding, and related information concerning printing and the allied industries.

Eleventh-grade printing is both general and vocational in nature depending on the interests and aptitudes of the individual students. Students are acquainted with the printed forms used in the public schools of West Allis. This school printing consists of tickets, posters, programs, report cards, absence slips, attendance sheets, record cards, school stationery, and the like. In addition to the study of the processes and problems in letterpress printing, students also learn the fundamentals of lithographic printing as applied to the Multilith machine.

Junior High School Drawing

Purposes: To develop the ability to make and read sketches and to learn the use of drawing tools through the making of simple drawings.

Content: 7A drawing covers three-view drawing, drawing to scale, lettering, and the use of instruments. Various types of drawings are made, that is: projects involving wood, machine parts, electrical drawings, map drawings, simple architectural drawings, and the like. The guide to the selection of content is based on citizenship and personal needs.

Senior High School Drafting

Purposes: To develop the ability to interpret drawings, represent one's own ideas in the form of sketches, and to make mechanical drawings of a high quality of craftsmanship. These purposes include the following:

1. To provide basic experiences which workers use in the majority of industrial activities.
2. To provide for those students who elect drawing with a definite vocational aim.
3. To provide experience of value for general citizenship needs and for personal use.

Content: 10B and 10A mechanical drawing cover such topics as: lettering, instrumental drawing, principles of dimensioning, sections, developments, pictorial drawing, geometrical constructions, machine fastenings, drawing from machine parts, the drafting vocation, blueprint reading, the making of blueprints. Detail and assembly drawings are made in the tenth grade.

11B and 11A machine drawing treat these topics: machine details, bearings, belts, pulleys, shafting and couplings, piping drawings, cams, gearing, including spur, bevel, and the worm and wheel, and working drawings, involving previous principles covered. Actual gear models are made in this grade.

Twelfth-grade drawing is devoted to architectural drawing. The following topics are studied: architectural letters and symbols, foundations and footings, details of brick construction, details of frame construction, types of houses, house planning, specifications, estimating the cost of the dwelling designed and drawn, financing the cost of the home. Complete plans are drawn for a modern dwelling including the necessary plans, elevations, details, and the specifications. Perspective drawings of the building are also made, and time permitting, scaled models of the home are made by the student.

General Information About All Courses Taught in the Graphic-Arts Shop

The work consists of two kinds — that is, manipulative work which takes up approximately 80 per cent of the shop time, and the informational content which takes the remainder of the time. All manipulative work is preceded by planning which involves sketches of what is to be made, work procedures, and bills of material or stock lists. As the work proceeds, demonstrations, lectures, lecture discussions, quizzes, and notebook work are given so that the learning develops along with the doing.

Students are required to pay for supplies used in the shop, either through a deposit, or by purchasing materials to be used from the school bookstore. Safety instruction and vocational guidance constitute a part of each semester's work. The social and economic problems involved in the transforming of raw material into finished products are considered important topics for discussion and study. Shop dress is prescribed by the teacher in charge of the shop. Where textbooks are adopted by the board of education, students may rent them.

7B Duplicating Method

The class is conducted according to the *general shop method,* that is, several activities are carried on at the same time. One group may be working at letterpress printing while other groups are working at gelatin duplicating, block printing, stencil duplicating, or other activities. The entire class is given instructions from time to time on selected units. Instruction sheets for the various activities are bound in manila folders, and are indexed. These folders are used during class discussions, and by students while planning and doing their work. Individual help is given to smaller groups and to individuals while they are working. Students are assigned individual responsibilities such as proofreader, librarian, custodian of equipment and supplies, and other duties. These responsibilities change each week.

Tenth-Grade Printing Method

Students are assigned to cabinets or work stations where they do most of their work, although some of the work requires them to use work stations other than their own. Students are responsible for the orderly appearance of their work stations at dismissal time.

The "I.T.U. Job Course" and Hague's "Advanced Composition" job sheets are used for instructional material in 10B printing. Instruction sheets written by the teacher are used for the 10A units in imposition, binding, block printing, and presswork.

Lectures and class discussions deal with informational content regarding the classwork, group projects, and topics of general interest. Demonstrations are given to small groups and to individuals.

Each student keeps a notebook containing his layouts, proofs, answers to questions on instruction sheets, and other material of value to him.

Eleventh-Grade Printing Method

The school production printing is done by the eleventh-grade printing students. In most cases one student carries the job through to completion. This consists of making the layout, composition, proofing and correcting, getting the customer's O.K., locking up, calculating and cutting the paper stock, making ready, feeding, distributing, delivering the job, and calculating the commercial price. Students keep records on job envelopes. Informational content is taught by the use of instruction sheets, class discussions, and by reading assignments from the shop library.

Method Used in Teaching Drafting

The method of teaching drawing is essentially the same at all levels. Each student is assigned to a bench. The drawing board, T square, triangles, and brush are numbered with the number of the bench to which they belong and are stored in the bench. Drawing sets which go with each bench are also numbered, but these are checked out by boys who work at certain benches. Special equipment is also checked out. Shop duties such as monitors, timekeeper, drawing checker, foremen, and instrument checkers are rotated in the class. Drawing boards are stored in the bench. Each student has his individual locker in the bench for his pencil, textbook, and other small supplies.

After the class is assembled, roll is taken. The boys at the benches in the front of the room get the envelopes which contain the boys' drawings from the drawing file and distribute the drawings. Meanwhile, other boys secure their keys from the key rack, open their lockers, and secure sets and special tools from the boys in charge of this equipment. Sets are checked out each class period so that but one set per level is needed. Since the shop is equipped to handle 36 students, 36 sets are provided.

A textbook is used in each semester of the drawing work. Work is assigned, demonstrations are made, and the work plan which follows, is adhered to in all courses: (1) the sketch is made showing views to be drawn, and is O.K.'d by the teacher; (2) the drawing is blocked out lightly; (3) the complete shape description is drawn in lightly; (4) size description, notes, and title are lightly penciled in; and (5) after a check, the drawing is penciled or inked. A lettering card is required with each drawing that is handed in. A chart is kept showing the progress of each student in the class. Grades are based on the number and quality of drawings made, on the recitations, and on tests and extra work. The checker checks drawings before they are submitted to the teacher. The timekeeper takes the roll, and the foreman has general charge under the teacher's supervision. At the end of the period the timekeeper calls time. Drawings are put in envelopes, sets checked in, envelopes collected and filed, all equipment stored away, lockers locked, and keys hung on the key panel. Classes are dismissed by the teacher.

Criteria for the Selection of Equipment

Facilities to be provided in the shop were based on the following:

1. That the purposes of the work were to determine the selection of equipment.
2. That an age range of 12–19 years was to be provided for.
3. That "unit" activities were to be run in drawing and printing and that duplicating would be run on the "general shop plan."
4. That classes up to 36 students were to be provided for.
5. That there would be adequate storage for supplies, tools, unfinished work, and shop library space.
6. That the shop equipment would be adequate in kind, range, size, and quantity to take care of all of the units to be offered.
7. That gas, electricity, hot and cold water, and other service connections for washing up would be available, with all electrical power 220 volt, a.c., 3 phase, 60 cycle.
8. That proper heating, lighting, and ventilation would be installed.

With the units to be offered and the facilities required as guides, tentative equipment lists were prepared. The list was in three parts: (1) general items or item used by all activities; (2) drafting equipment; and (3) printing and duplicating equipment. Drawings and specifications were made for benches and other furniture. Specifications were drawn up for the machines and the equipment. With the equipment sizes determined it was possible to draw shop plans. These were drawn with the temporary barracks as a guide, since the shop would be housed in this building until the shop unit of a new building is completed.

Facilities Used by All Activities

The graphic-arts room is 23 by 62 ft. There are ample blackboards, bulletin boards, washing facilities, lighting, electric power, and electric convenience outlets as shown in Figure 1, Graphic-Arts Shop. The file next to the teacher's desk is desk high. There are filing drawers for 3 by 5 and 5 by 8-in. cards in the upper sections of the drawing file, Figure 2. Books, catalogs, and other material for shop use are stored in the cabinet in the rear of the room. Keys are kept in the key cabinet which is near the instructor's desk. Keys for each class are hung on separate panels. Only keys on the panel for a given class can be taken from the cabinet by members of the class. Other panels are locked up. All panels may be turned in and locked so that no keys are available. The use of the equipment for the activities offered in this shop will be described in turn.

Use of Equipment in 7B Duplicating

As previously stated, several graphic-arts activities are carried on at the same time in 7B duplicating. This procedure makes it possible to offer a wide range of work with a minimum of equipment. The benches shown as drawing tables in Figure 1, and illustrated by Figure 3 provide work stations for setting type and for planning jobs. Additional work stations are provided by the type cabinets and by the worktable shown in Figure 1. This worktable contains drawers and shelves for storage of duplicating equipment and supplies. The stock cabinet in the corner of Figure 1 holds paper stock and other instructional material. Each student has access to a galley for storing his printing jobs. He also has a drawer in a bench for his individual materials.

Figures 4 and 5 show students working at typical activities of the course. Figure 4 shows pantographing, cutting a decorative stencil, stencil duplicating, and locking up for letterpress printing, while Figure 5 shows stencil duplicating, block cutting, and gelatin duplicating. The Pilot lever presses, Figure 6, serve for printing the small jobs done in letterpress printing.

Use of Equipment in Tenth- and Eleventh-Grade Printing

The floor plan, Figure 1, shows the printing equipment centralized in one end of the shop. The cabinets shown in Figure 3 serve as work stations for setting type, for planning jobs, and for written assignments.

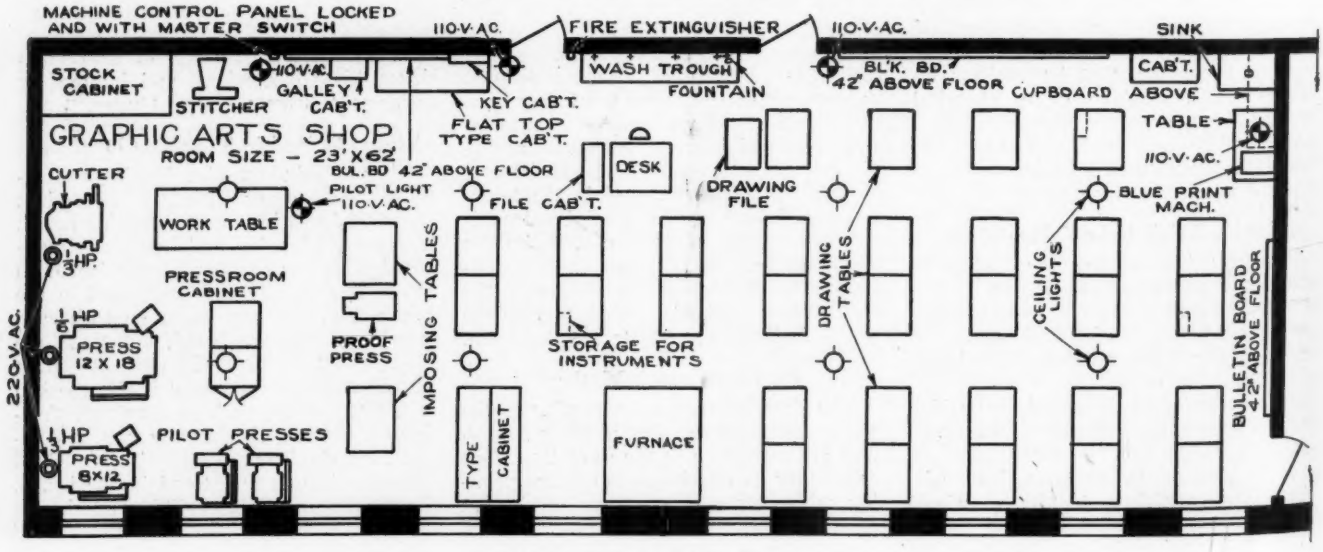


Fig. 1. Plan of graphic-arts shop

Each student is assigned a galley where he keeps his printing jobs and his notebook. Storage space for paper stock and additional students, however, may be accommodated by using the type cabinets which are the correct height for drawing. The six individual drawers in the bench are fitted with locks. The large space at the left in the bench, Figure 3, is used for

Filing

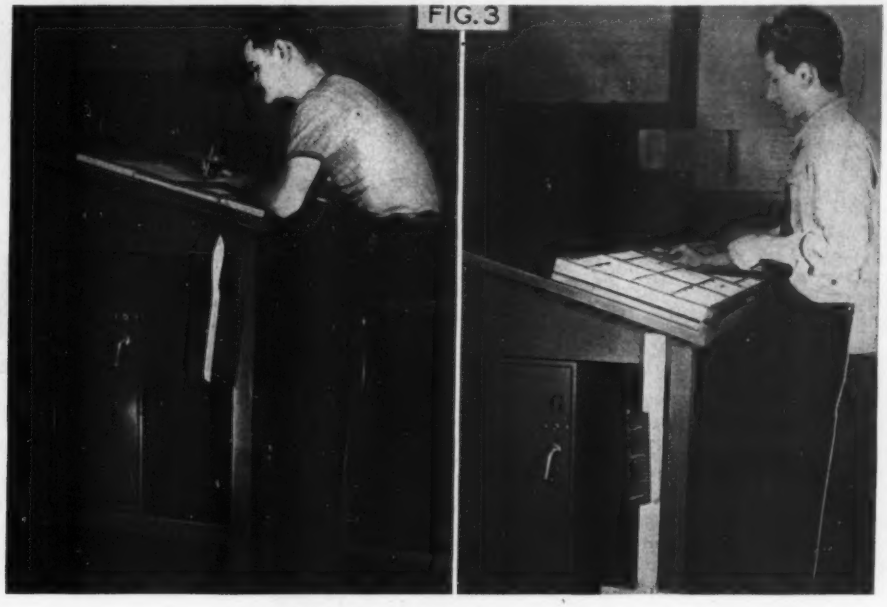
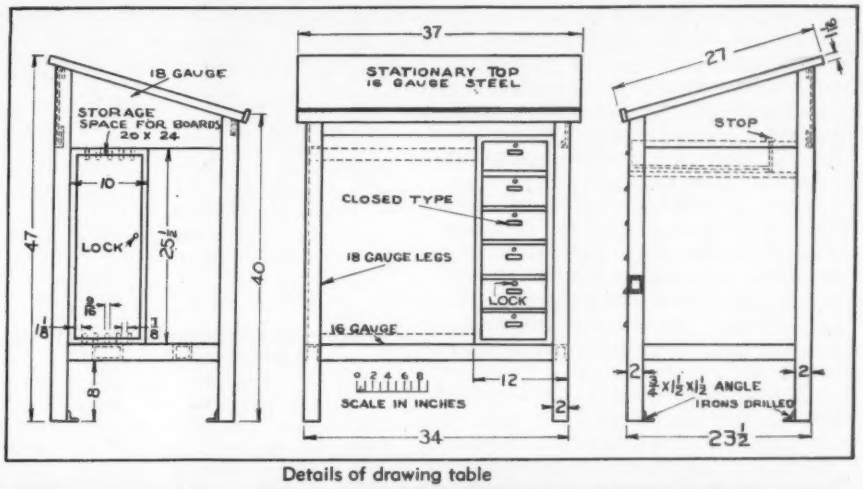


Table used for drawing and for setting type

instructional material is provided for by the stock cabinet, by the drawers in the worktable, and by the pressroom cabinet shown in the floor plan. Two imposing tables allow ample space for problems in imposition and locking up forms. Figure 7 shows students at binding and locking up. Figures 8 and 9 show the presses used for instructional purposes and for producing the school production printing.

Arrangements for Junior High School General Drawing and Senior High School Drafting

The drawing is done at the combination drawing and typesetting benches. Figure 10 shows a drawing class at work. Figure 3 shows the bench used as a drawing table. There are 30 of these benches. This number provides for a normal-sized class. Six



Details of drawing table

Linoleum-block cutting

Duplicating

FIG. 6

At the presses

FIG. 7

Bookbinding

board storage. The T square and brush are hung on the bench. Drawings are filed in the drawing file, Figure 2. The upper drawer of this file is made to accommodate 9 by 12-in. drawings for junior high school classes, and the lower compartment is constructed to hold 12 by 18-in. senior high school drawings. The file drawers are also fitted with locks. The blueprinting is done on the horizontal machine, shown in Figure 11, which uses flood lamps for light. Supplies for drawing work are stored in the cabinet above the sink and adjacent to the blueprinting device. In three of the benches, the board storage space is provided with an instrument file for the storage of instruments. The equipment permits the following class routine which agrees with the method stated previously: (1) get key from key cabinet and unlock individual lockers, (2) roll call, (3) get T square and board from bench, (4) get instruments from *check out stations*, (5) monitors secure envelopes containing drawings filed in the drawing file and pass out to students, (6) at cleanup signal put drawings in envelopes to be collected, (7) return sets and instruments, (8) put materials away in individual lockers, (9) hang up keys on key rack, (10) dismissal. The plan followed makes it possible to make use of the same set of equipment for all drawing classes, and provides a check on all equipment. All student supplies, drawings, and books are locked up at the end of the period.

Equipment Information

The equipment is divided up into three kinds: (1) general equipment which is equipment used by all activities, such as benches, stools, cupboards, key racks, teacher's desk, chair and file; (2) printing and duplicating equipment; and (3) drafting equipment. It may be of interest to know the approximate cost of the equipment which we have been describing.

General Equipment

30	benches	$1,380.00
36	stools	73.20
1	key case	22.55
1	cupboard	17.50
1	teacher's desk	35.00
1	teacher's filing cabinet	10.19
1	teacher's chair	7.50
	Total	$1,545.94

Printing and Duplicating Equipment Machines and Furniture

1	8 by 12-in. platen press, complete	$ 496.67
1	12 by 18-in. platen press, complete	762.40
2	6½ by 10-in. Pilot lever presses	194.00
1	Pressroom cabinet	176.40
1	26½-in. paper cutter	285.00
1	No. 5 stitcher	201.39
2	imposing tables, complete with furniture	541.94
1	steel type cabinet, complete with cases	179.00
1	steel flat-top cabinet, complete with cases	132.30
1	galley rack with galleys	29.60
1	proof press, complete with cabinet	53.00
1	stock cabinet	158.50
1	worktable	156.95
	Total	$3,367.16

Miscellaneous Printing and Duplicating Equipment

This includes all type, spacing material, composing sticks, and smaller equipment for the graphic-arts activities, such as stencil duplicators, gelatin duplicators, pantographs, engraving tools, and miscellaneous equipment. Total, $1,450.28.

Drawing Equipment Furniture and Machines

1	Drawing file	$ 42.00
1	Storage cabinet	21.00
1	Blueprinting worktable	14.50
1	Blueprinting machine	75.00
	Total	$ 152.50

Individual and General Drawing Equipment (Miscellaneous)

36	Sets of instruments	$ 198.00
36	T squares	36.00
72	Triangles	28.80

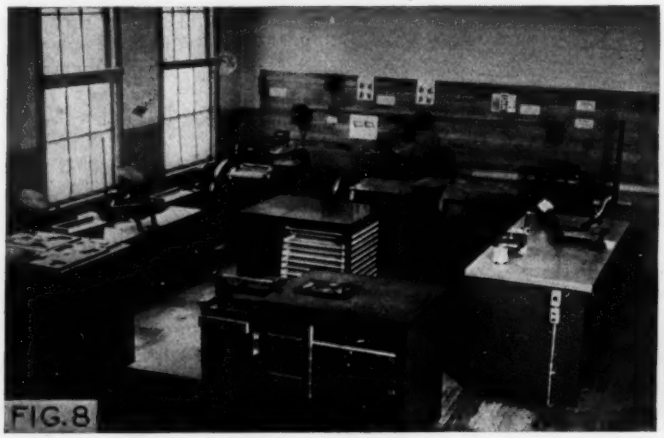


FIG. 8

The printing section

FIG. 9

Learning how to feed

FIG. 10

Drafting

FIG. 11

Making blue prints

36 Brushes	14.40
36 Scales	14.40
12 French curves	8.20
72 Drawing boards	72.00
General equipment	56.00
Total	$ 427.80
Grand Total	$6,943.67

The Purchase of the Equipment

In most situations it is both necessary and wise to secure bids on the equipment which is to be bought for school shops. This entails a great deal of careful planning in order to save time, labor, and confusion in selecting the best bid. It may be of interest here to briefly indicate what our experience has shown to be desirable when making up equipment proposals, and to illustrate part of an equipment proposal by showing the specifications on the graphic-arts bench which was designed for the graphic-arts shop.

Items to Include When Preparing Equipment Bids

1. Equipment Proposal Blank

Item Number	Number Req'd	Description	Unit Cost	Total
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....

Signature of Bidder .....
Per .....
Street Address .....
City .....

2. Advertisement for Bids — Copy
3. Specifications — Include
   a) Scope.
   b) Descriptive literature.
   c) Instructions as to guards, electrical control, kind of power, motor ratings, machine bases, belts, and the like.
   d) Delivery — place, assembled or knocked down, electrical connections.
4. Damages and final inspection
5. Over-all sizes
6. Alternate bids
7. Royalties and Patents
8. Guarantee

Detailed Specifications on Graphic-Arts Bench

Thirty required.

Graphic-Arts Bench

See Figure 12. Thirteen tables to have drawers on the right and drawing-board storage on the left; 17 tables to have drawers on the left and drawing-board storage on the right.

The tables to have a top 27 by 37 in.; base 23½ by 34 in., to contain six individual drawers, provided with locks; storage space for six drawing boards 20 by 24 in., the doors provided with locks; locks on drawers and doors of the same series, three keys for each lock and three master keys. The drawer sections and the drawing-board-storage sections are to be made separate from the table chassis so that the sections may be reversed in the tables.

The top to be 27 in. deep and 37 in. wide, 47 in. high at rear and 40 in. high at front, 1 1/16 in. thick and to be of best-grade 16-gauge furniture steel. Top to be rigidly braced with metal or provided with wood core so it will not be noisy in use. A steel retaining ledge to be provided on the front edge of top. To be finished with three coats of enamel.

The frame posts are to be 2 by 2 in., 18-gauge steel tubing welded. The top rails and stretchers are to be made of channel-shaped 18-gauge steel. The lower end rails and stretchers are to be made of channel-shaped 16-gauge metal. Legs to be equipped with angle irons arranged for fastening table to floor.

The drawers of steel, exterior dimensions 8¾ in. wide, 4 in. high, and 18 in. deep provided with catches or stops so they cannot be moved by working from upper and lower drawers. Bottoms to be provided with ¼-in. 3-ply birch or ⅛-in. pressed-wood liner snugly fitted. Pulls 4-in. pressed steel. Drawers to be fitted with double-cylinder pin-tumbler locks. Compartment frame for drawers 20-gauge or heavier metal. Drawer material and construction to be such as to provide a rigid drawer and one which will operate smoothly and with little effort.

The drawing-board compartment to be of steel 10 in. wide, 21¾ in. deep, 25½ in. high and arranged to contain spaces for drawing boards 20 by 24 in. The top and bottom of the compartment to be made of wood or substitute and the cleats separating the boards are to be made of wood or substitute and to be glued and screwed in place. The compartment is to be of 20-gauge or heavier steel.

Gauges of metal legs, 18 gauge; top, 16 gauge; upper rails and stretchers, 18 gauge; lower rails and stretcher, 16 gauge; compartment for boards, 20 gauge; unit for drawers, 20 gauge.

Material — all steel unless otherwise specified to be cold-rolled furniture steel, which has been reannealed and pickled to remove all foreign matter and then leveled to prevent buckling.

Finish — olive-green baked enamel.

Alternate — Tables as specified above but made entirely of birch. Top and retaining ledge to be covered with No. 18-gauge steel plate. Table to be finished school brown.[5]

Having made all arrangements for the purchase of the equipment for the graphic-arts shop, the final piece of work was to write the instructions for the maintenance department to prepare the buildings — in this case a double barracks, so far as room facilities were concerned — and to install the equipment. Figure 13 shows what these instructions covered.

Conclusion

This article has discussed the problems involved in the planning, selection, purchase, and use of equipment. Although considerable time and effort are entailed in the planning of equipment, the resulting advantages more than justify this time and effort.

Consequently, the graphic-arts shop which was recently put into operation has been found to be adequate and flexible. The equipment provides for large classes and permits a variety of methods and techniques. The furniture is made of steel. It should last a long time and be free from burdensome maintenance costs.

We believe that the graphic-arts equipment and facilities as planned and installed will make it possible to carry out the aims and objectives of the graphic-arts curriculum in its relation to the total program of industrial arts.

[5] *Proposals for School Furniture, Cabinets and Machines*, Nathan Hale High School, West Allis, Wis., May 23, 1940. pp. 10–11.

Shed no tears over your lack of early advantages. No really great man ever had any advantages that he himself did not create. — *Elbert Hubbard.*

Enthusiasm is shown to the best advantage in the quality and quantity of the work you do. — *Charles R. Gow.*

The Pull of a Purpose

DEAN M. SCHWEICKHARD*

A Symbol of Strength

Up to a generation ago the horse was a very essential item of equipment on the farm. Sometime earlier that same animal furnished the necessary motive power for the transportation of people and goods in cities great and small. He was used to move boats along the canals, and to haul supply wagons and artillery in the army. In the selection of draft horses for any of these or numerous other purposes, the final measure of effectiveness always lay in the strength of the pull which could be exerted.

Now that most of these services have come to be performed by automotive means the test is still one of pulling power. In the physics laboratory the force of gravity acting upon weights of different sizes is measured in terms of the comparative pull on a cord running over a pulley. The office clerk pulls cards from the files; the gardener pulls radishes, carrots, and young onions from the ground; and now and then we are unpleasantly reminded that the dentist's method of removing a tooth is by means of a pull.

Anyone who has driven a car for long has sooner or later found himself stalled because of faulty ignition, an empty gas tank, a low battery, or poor road conditions due to snow, sand, or mud. Under such circumstances the most common means of getting under way or getting to the repair shop is to get a pull from someone else who has the necessary power at his command and under his control. Sometimes it is a push instead of a pull, but it is only a question of relative position, and in the end accomplishes the same result. In all such instances the service is looked upon as temporary and is in no way thought of as a permanent means of propulsion.

A story of one of the classics projected on the motion-picture screen depicts a ship being dashed to pieces on a rock-bound coast. The crew is in imminent danger, and their only hope of rescue lies in the possibility of securing help from a lifeguard on shore. At the risk of his own life one member of the guard makes his way to the ship with a light line attached to his belt. With this line a heavier one is pulled to the ship, and finally a hawser strong enough to provide the pull to safety. The actual hand-over-hand pull on the ropes was essential to the rescue, but the most important force of all was the one which impelled the swimmer to make the plunge and battle his way through. Without that pull the others would not have been possible.

*Assistant Superintendent of Schools, Minneapolis, Minn.

Pulling or Drifting

At this time of year when thousands upon thousands of young men and women are finishing school, new plans are being made and new quests are being undertaken. Some are looking for jobs, others for ways by which they may go on further in school. Occasionally one who fails to comprehend the true and lasting forces which keep the affairs of the world moving is heard to say, with a pessimistic note, "If I only had a pull I could get a job, or I could get a scholarship."

The deplorable part of such an attitude is that it usually implies that the pull is exerted through favoritism and not because of merit. The more encouraging side is to be found in the fact that most young people seeking jobs, scholarships, and other awards worth having, realize, and have realized long before the day of final reckoning, that the kind of a pull that counts is the setting of a purpose far in advance, and moving steadfastly toward it. Those who have the responsibility for employment or the awarding of honors are not looking for favorites upon whom they may confer special unearned favors. Rather, they are looking for individuals who possess a desirable combination of qualities, the chief of which are: (1) the foresight to choose a worth-while goal, (2) the energy to pursue it persistently, and (3) the ability to achieve it successfully. They know that the one whose pull has come through those qualities in the past is most likely to be pulled by the same or similar ones in the future.

Even in the aquatic realm the fish with a purpose is sought after by the sportsman as well as by the master of the culinary arts. The salmon or trout swims upstream, thrills to the tingle of rushing water, and sees in every rapids a challenge to be met. He is not satisfied until he has attained the top, not by being carried but by means of his own strength, skill, and determination. The carp or other sluggard seems satisfied to lie in the stagnant pool and wait for his food to drift by or settle to him from the surface. Unlike the trout he would not even recognize the waterfall as an opportunity, much less attempt to cope with it.

The comparison between man and animal, of course, fails in one very essential particular. Through a long process of evolution, each kind of animal, each family, and each species has had its purposes pre-established. The force of instinct pulls each succeeding generation toward these established purposes or goals and little volition is exercised by the individual. Each exerts such energies as he has toward the ends for which he was created, namely: (1) to secure food, (2) to find shelter or protection, and (3) to reproduce his kind.

The Power of Discrimination

Mankind, on the other hand, has been given the power to discriminate between the goals he would seek. When he uses constructive intelligence where the lower animals make use of instinct, he does much to create for himself ever wider opportunities, and attains greater heights through the establishment of nobler purposes. Sadly, however, freedom for independent action opens the way to seek unworthy purposes as well as worthy ones. The pull toward the one kind of purpose may be just as strong as the pull toward the other, but the end results are far from being equally satisfactory.

In Tolstoi's story "Evil Allures, but Good Endures, Aleb, the shepherd, set for himself the goal of inciting his master to anger. In seeking to accomplish his purpose he broke the leg of the master's most prized ram. The master, however, had set for himself the goal of holding his temper and never giving way to anger. Instead of venting his wrath upon the shepherd he dismissed him from his service with a note of sadness. The boy had attained his freedom but he knew not what to do with it, for he had not learned to discriminate between the various purposes toward which a free man may be pulled.

Abraham Lincoln once said, "I am not bound to win, but I am bound to be true. I am not bound to succeed, but I am bound to live up to the light I have. I must stand with anybody that stands right; stand with him while he is right and part with him when he goes wrong." In this declaration, Lincoln revealed a fundamental truth that man is forever being pulled by some purpose, high or low, and the only way to attain a worthy goal is to constantly respond to the pull of a purpose which is high. If this simple creed were to be carried out by every youth going forth to face the world, it soon would pervade industry, business, home life, and government, and the nation would stand at the forefront of the world because it possessed the might which comes from being right.

The talent of success is nothing more than doing whatever you do without a thought of fame. If it comes at all, it will come because it is deserved, not because it is sought after. — *Longfellow.*

It is the minute of talk after the hour of thought, the ounce of effort after the hour of preparation, that brings the business into the harbor of success. — *Calpet Mission.*

INDUSTRIAL ARTS and VOCATIONAL EDUCATION
John J. Metz, Editor

At the Close of the School Year

With the end of the school year in the offing, INDUSTRIAL ARTS AND VOCATIONAL EDUCATION has tried to include as much immediately helpful material in the present issue as space permitted. Of course, other issues of the magazine carried tests that might be of help at this time, but the offerings this month were chosen because of their special timeliness. Among them are one test for the print shop, one for the student of general metal, one for the woodworking class, one on the micrometer, and three for the drafting room.

The tests published may not suit all conditions nor every teacher. It is doubtful whether anyone will ever be able to write a test that will be generally acceptable. However, the tests presented this month have served a useful purpose in some classes, and they may serve equally well in others. If they do nothing else, they show what can be done, and they do present a pattern for anyone who wants to apply the testing technique.

Probably the best method of making use of these tests was described by Roy R. Van Duzee and H. C. Rose in an article entitled, "Card File Test Building" which appeared on page 240 of the June, 1939, issue of this magazine. These authors suggest that test questions from all legitimately available sources be collected, and that they be entered singly on individual cards and then filed under subjects, such as woodworking, metalworking, drafting, and the like; and under the various types of questions, i.e., true-false, completion, multiple-choice, and so on. Cards should also be prepared bearing the standard headings used with the various types of questions.

It will be found quite a simple matter to obtain a collection of such questions which will quickly run into the hundreds. Then when a test is to be made up, a half hour will suffice to choose suitable questions from such a file, add a suitable heading card, have the material typed and be all ready to apply a test which will suit the needs of any class or course.

Another necessary thing to consider at this time of the year is the preparation of an inventory. Many instructors have worked out a technique for accomplishing this very important job with comparative ease. Others dread the drudgery which the job entails, because they have chosen a rather cumbersome method of doing the work.

George W. Deffendahl, in his article, "Industrial-Arts Shop Inventory" on page 236, presents his way of taking the inventory of his shop. Some teachers may find that the form which he devised will serve their purposes equally well. Others may find that they will have to augment the list which he presents. At any rate, his article contains a method which he has planned, used, and found satisfactory. It, therefore, deserves the reader's careful attention and study.

Some school shops will not be closed for the summer, because they will be used by National Defense Training classes. Keeping accounts for these classes is likely to be a troublesome job. Probably here, too, the interested reader may find helpful suggestions in the article by Harold J. Van Westrienen which appears on page 237. This article, entitled "An Accounting Technique for National Defense Classes," presents a form that has helped this busy director to satisfactorily solve this problem for a community that is largely composed of industrial workers. It may benefit others as well.

There may also be some directors, supervisors, or teachers who are confronted with the task of planning, equipping, or altering one or more school shops. They are referred to the article entitled, "Planning and Equipping a Graphic-Arts Shop" by Roy R. Van Duzee and Raymond W. Sturm on page 219 and to the article on page 238 which Roger J. Weaver submitted under the title, "Initial Steps in Planning Shops."

Of course, the foregoing suggestions do not begin to cover all of the items that are confronting the conscientious shop instructor as he prepares to close the school year 1940–41, but they do touch upon important phases of the teachers' work, and for this reason they were thought worthy of mention.

The Task Confronting Us

Vocational schools will be interested in the recommendations made by the school superintendents, who, under the leadership of Dr. Edwin A. Lee, dean of the School of Education of the University of California at Los Angeles, made a tour which began on April 14, at Los Angeles, and concluded in Seattle on April 22.

The recommendations of these superintendents emphasize the necessity of stepping up the training of workers for defense jobs. To do this, they say that the schools must start training men and women for national defense industries even before these industries have enlarged or built their factories to increase the rate of production. Those school shops which lack power equipment may still start doing their part, by giving needed preliminary training. Many school systems have not yet experimented with the 24-hour school day that has been found so effective in some cities. This method of extending school-shop facilities possesses great possibilities, and may well be tried out. America is confronted by conditions of such gravity that no delay must be countenanced.

Shop teachers have a wonderful opportunity to show the world what the schools can do. They will not be found wanting if their superintendents give them a real chance.

Are You Changing Your Address?

Recently we received a letter from a subscriber stating that he had failed to get his magazines for several months. He had subscribed to INDUSTRIAL ARTS AND VOCATIONAL EDUCATION while he was attending a teacher-training institution. When he graduated, he was fortunate in obtaining a position at once, and weighted down with the duties of his first job, he failed to notify our Circulation Department of his change of address.

The monthly issues were sent regularly to his former address at the college. They were not returned to the publisher, and now cannot be replaced, as the stock of back issues is exhausted.

Other teachers will shortly be in the same situation as the one just referred to. A post card suffices to notify us of any change of address. There are no July and August issues of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, but the September issue comes off the press on August 15. Subscribers should be sure to let us know where to send this school-opening number, so that they may get it in time for their own school-opening date.

Learning by Doing

RAYMOND D. MEADE*

School buildings are universally dedicated to the housing of educational activities; but in few cases have they become such an activity in themselves. At Bloom Township High School in Chicago Heights, Ill., the construction of a new vocational agriculture annex recently completed and immediately dubbed "Bloom Junior" by the student body has provided the school with a new and much needed addition to the school plant while affording students in carpentry, home wiring, plumbing, heating and ventilating, sheet-metal work, and architectural drawing and blueprinting with practical educational experience in their various fields.

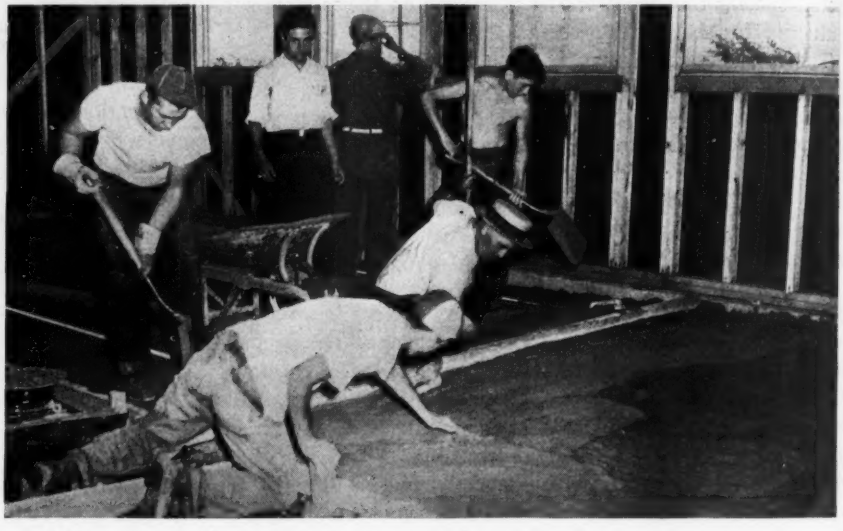
The need for a special building for use of the vocational agriculture department became apparent soon after the completion in 1934 of the present million dollar building.[1] Heavy enrollment in both day and evening school taxed the facilities of the agriculture department of the school until it became evident that some provision would have to be made for the overflow. Evening classes for adults which crowded ordinary classrooms with 80 adults evening after evening, caused the board to approve plans for additional facilities.

After considering a small building to contain classes dealing with live poultry only, it was decided to construct a more elaborate building that would house a complete vocational-agriculture department of classrooms, laboratories, an office, and a departmental library.

The services of the Masonite Corporation's architectural-advisory staff was secured to assist in the preparation of the plans. This group cooperated in the development of plans and specifications that were turned over to the school's classes in architectural drawing under the direction of R. L. Ignelzi, building trades instructor at Bloom.

With basic plans determined, the young architects were divided into smaller groups, each undertaking some special task in the preparation of the construction details. Plumbing details were laid out by one group. Another detailed wiring plans. Heating, ventilation, and other structural details were completed by still other student groups. The entire project became one of practical experience in architectural design.

Cooperation of organized labor in the community was enthusiastically given. School authorities appeared before a meeting of the building trades council to present the project in detail. It was pointed out that the primary purpose of the project under consideration was not to erect a school building at a saving to the school board; but to give future craftsmen of the Chicago Heights area practical experience in construction work. The school employed one representative from each of the trades groups involved to supervise the work of the boys in his particular type of work. The opportunity to cooperate with the school's program was welcomed by the skilled tradesmen of the community. These representatives not only helped supervise construction, but gave personal assistance in the specialized trade training of the young craftsmen.

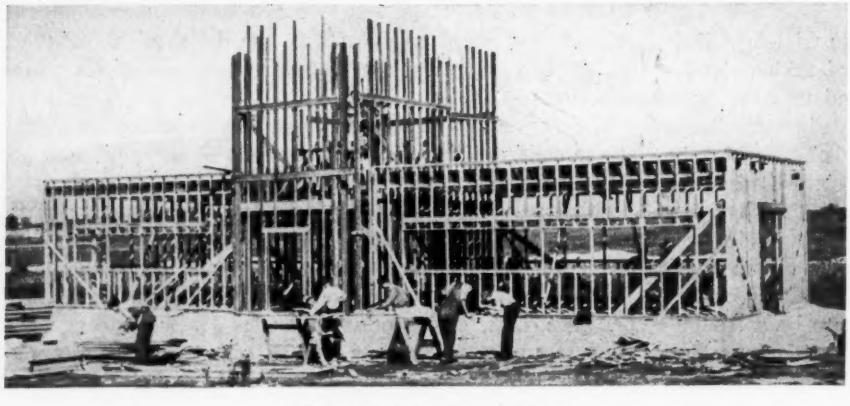


All first-story floors are poured concrete

The original plan called for a structure 66 by 24 ft. This unit was completed early in 1940. Before construction was completed, it was evident that the rapid growth of the agriculture department warranted additional space. During the summer of 1940 a new wing 24 by 36 ft. was added. As now completed, the building is simple in design and follows closely the architectural balance of the main building. This similarity of design accounts for the name "Bloom Junior" being attached to the annex by the student body.

The general plan of the building presents a two-story central structure with a single-story wing on either side. The east wing includes a large 24 by 36-ft. farm shop with facilities for work in farm mechanics in addition to a classroom with motion-picture projection equipment. The west wing is laid out in four rooms for the teaching of experimental poultry work, poultry feeding, mixing mash, and the like.

The entire unit is constructed throughout of Masonite products. Structural insulation was placed over the studding and tempered pressed wood provided the exterior surface. Insulation board was used



Framing of the central unit

*Principal, Bloom Township High School, Chicago Heights, Ill.

[1]For description see October, 1938, issue of *The American School Board Journal.*

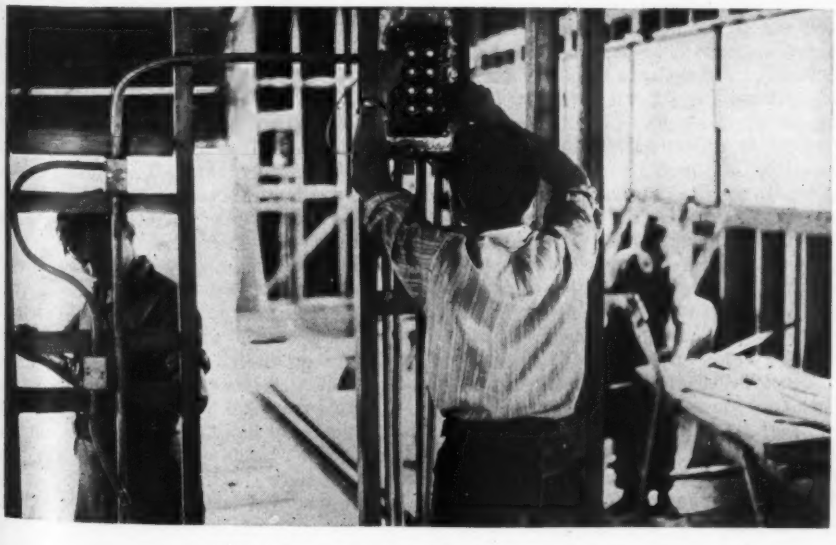
Sheathing for preparation for built-up roof

for the interior. Heating, wiring, plumbing, timing system, and public-address connections are all integrated with the facilities in the central building. The actual cost of the unit has been set at $3,800. Construction by customary methods would have cost the school approximately $8,000. In addition to providing the students with the most effective training method possible, considerable saving has been possible to the school district.

Educationally, the worth of the building cannot be accurately estimated. Bloom Township High School is situated in a community almost completely industrial, surrounded by an agricultural area in which poultry, dairying, and small crops constitute the major farm activities. Less than 10 per cent of Bloom's graduates continue with college work. The real demand upon the educational system is for vocational training in the various fields. Complete shop facilities for elementary and advanced vocational training in wood, metal, mechanics, and the like, are available in the main building. However, the board of education felt that the vocational program was not complete unless opportunity was provided for students to test their skill in actual production work. Adequate provisions for this type of trainning had already been made for students in other vocational fields. The construction of "Bloom Junior" has provided similar training for members of the building trades classes.

Learning by doing has been emphasized as a sound educational technique. The classroom atmosphere has given way to actual *on the job* situations. Greater interest on the part of the building trades boys was created through the knowledge that they were constructing a building that would become a part of the school plant instead of working out an exercise devised by a teacher as a teaching method. Nearly every type of skill required in construction work was called forth as the project developed. Although students in carpentry received the greatest amount of training, all other groups in the building trades department were called in for special tasks.

All exterior surface is masonite "predwood"



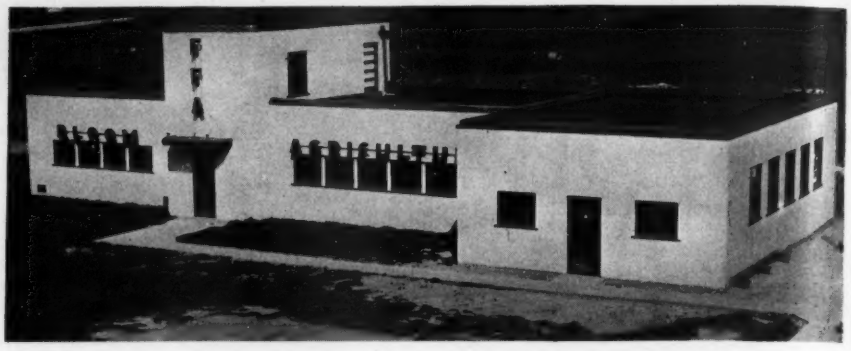
All electrical work in building was concealed

Some training in cost estimating and related phases of construction work was included when students were permitted to sit in on meetings in which plans were being discussed by official groups.

As a result of the addition of Bloom Junior to the school plant, vocational agriculture has become one of the most popular of school departments. Practical work in soils, crops, animal husbandry, and farm mechanics has been offered. The school has become a center for adults interested in agriculture as well as for students of school age. At the present time extensions of the department are being planned in the field of hybrid corn development and experimental poultry breeding. Through careful planning and foresight by a progressive board of education, a

school has been able to serve its community more completely, provide valuable training for its students, make additions to the school's physical plant, and at the same time save money for the district.

Experience gained in this project is being used to continue the program of student building. Plans are already under way calling for the construction of a series of residences in the city as well as for minor improvements and additions to the school plant. Throughout the entire vocational program runs the educational principle that one of the best methods of teaching is to give students an opportunity to learn to do by doing.



Completed structure is adjacent to main school structure

Meeting Vocational Needs in an Institution

J. E. BALMER*

Definition of Vocational Education

Before we discuss this subject it is necessary to explain the meaning of vocational education. During the past two decades vocational education has advanced rapidly. Just last year there was an increase of 25 per cent in the enrollment of vocational schools. This interest has been going on with greater impetus since the passage of the federal Smith-Hughes Law in 1917. Vocational education is defined by this law as follows:

1. The controlling purpose will be to fit for useful employment.
2. It must be less than college grade.
3. It is for persons over 14 years of age.

It can readily be seen then from these three provisions in the Smith-Hughes law that the high school period is the time when a child should be trained for useful employment and not for college entrance. What caused this change in our attitude toward training high school children? Why should the Federal Government appropriate large sums of money, giving dollar for dollar, to the states to advance the interest of vocational education? Following are just a few of the reasons:

Reasons for Rapid Expansion

1. Compulsory attendance laws which required children to stay in school until they were 16 or 18 years of age brought to our secondary schools many children who otherwise would not have been there. A great many of these children could not benefit by the type of education that was being offered. In a recent issue of the "Yale Review" Mr. Donald G. Bridgman makes this statement: "Only 40 per cent of our high school students can cope successfully with a classical academic curriculum." If people were starving and food were provided which they could not eat, much less digest, we would have something corresponding to the situation that prevailed in most high schools. There was education for those who could take it. For the rest it was indigestion, pain, distress, and plain starvation. Vocational education was intended to provide for some of the 60 per cent who could not digest the academic subjects. "It came as a protest movement against the ponderous and self-sufficient lethargy of the academic school system and because academic school systems refused to try to solve the educational problems of the great group of children in the *underdog* class."

2. Many educators discovered that children could not be educated by merely steering them into study halls or libraries. Some school administrators feel that study halls are often more of a menace than a benefit. A child with a low intelligence cannot concentrate for an hour at a time despite all the good intentions of his teachers in exposing him to an environment that may contain many worth-while books. In reality study halls have often served to develop loafing habits in children. These same children could have been learning useful skills if they had been in a vocational environment.

3. If there were more vocational schools, crime might be reduced very greatly. A former pardon attorney of the state of Missouri declares, "Nearly three fourths of the persons found in our penitentiary are persons unable to earn a living excepting at the most rudimentary kinds of labor. The maximum dishonesty exists where the minimum of earning power is present. Only one fourth of our convicts are illiterate. Three fourths of them are incompetent." A great many of our criminals are those who have been sloughed from the schools that provide only abstract academic training.

4. The great increase in the cost of a college education has made it impossible for any but the favored few to continue in school above the twelfth grade. The high school is the finishing school for 90 per cent of our children, therefore, the training should be of a practical nature. It should be training in skills that can be sold for money when the child goes into the open market of competition for a living.

5. The rapid changes in industry have upset educational procedures and made necessary a type of school curriculum materially different from what was offered a decade or two ago.

Vocational Education at the Xenia Home

Vocational education for institutional children is much more important than for children in public schools. Usually they have no fond parents to support them indefinitely. They must become economically independent almost as soon as they leave the institution. In our particular institution at Xenia the statistics for the past 10 years show that 93 per cent of our children completed their formal education when they graduated from our Home High School. Of the high school graduates in the past 10 years not one has yet graduated from college, and the probability is that less than 2 per cent of all of our high school graduates during this time will be college graduates. Of the total of 440 children discharged, only 12 are in college. It can be readily seen then why vocational education is so necessary for our children.

Of the 20 years that the writer has been

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engaged in the teaching profession, 10 years were spent in public schools in Ohio. In the past 10 years his efforts have been in the Ohio Soldiers' and Sailors' Orphans' Home at Xenia, Ohio, an institution with an average population of 700 children ranging in ages from four to 18 years. Fortunately our institution is large enough to offer many occupational opportunities for children not available in smaller institutions or in public schools. When the laws were formulated adequate provisions were made to insure vocational training for each child. The laws that apply to this institution state:

> The trustees shall establish and maintain shops wherein suitable trades may be taught and practiced in a thorough comprehensive manner.
>
> Any branch or industry introduced shall be taught and practiced in so thorough and comprehensive a manner that the institution shall be considered a model school for these particular branches.
>
> Each pupil may select a trade of occupation to which such pupil desires to engage and any pupil remaining in the Home after completion of his or her sixteenth year must devote himself or herself for the time remaining to one of the courses of instruction or trade provided in said Home, except in case of disability or ill health.

There has rarely been a time in the history of our Xenia Home when vocational training was not offered to the children. There was a time when this training fell into disrepute and for some years could hardly have been called vocational education. An investigation made by the American Legion in 1927 resulted in demands that the occupational facilities of the institution be better used in the effective training of the children, and in 1929 there was a reorganization of the vocational training. Our first task was to make a survey to discover what we had in pupils, equipment, and teaching personnel. We invited the state director of trades and industries to help in this appraisal after which we set up four broad vocational objectives. These objectives are:

Present Broad Objectives

A. To guide the child into an occupation where there is some chance of his succeeding and in which he has some interest.

B. To train the child in his chosen occupation so that he can market his training when he leaves the institution.

C. To place each child in a position in the field of his interest and training.

D. To follow up for a period of at least three years to see if a satisfactory occupational and social adjustment has been made.

To guide a child into an occupation where there was some chance of him succeeding and in which he had some interest.

Vocational guidance was important enough to be included in President Hoover's White House Conference on Child Health and Protection held in 1932. Child welfare workers realize that children do not start life with the same chances. Nature knows no democracy. Heredity produces individual differences in boys and girls which must be considered in preparing for life careers. For a long time the word *guidance* was a much misused term. Many well-meaning, enthusiastic, though superficial speakers who wished to do something for the growing generation found in this activity an outlet for their enthusiasm. Generalities, emotional appeal, pep talks, sentiment, and other *hitch your wagon to a star* inspirations must be supplemented by scientific data before much good may be accomplished in the field of guidance. Wise vocational guidance will make it possible for oncoming workers to be much more contented with their lots in life. In the past the cost of making unwise occupational choices has been very high in both money and happiness. Millions of workers have drifted into the first available job and somehow have been unable to steer themselves elsewhere.

In our Xenia institution the first step taken toward a practical guidance program was to set up a *tryout program* where children during the seventh, eighth, and ninth grades may spend from one to three hours per day, rotating from occupation to occupation in an attempt to discover interests and aptitudes. This is much more satisfactory than lecturing or reading about occupations. This tryout period gives the teachers a chance to appraise the aptitudes of children and to advise them in their future occupational decisions. By starting children at this early age it is possible to develop habits of industry, patience, promptness, cooperation, and many more of the other character traits necessary in most jobs. During this tryout period an extensive testing program is carried on in an attempt to supplement the manipulative experiences. We use such tests as the Minnesota Assembly Test, the Stenquist Mechanical Aptitude Test, the Minnesota Clerical Test, the Detroit Mechanical Aptitude Test, and of course, we use achievement and general intelligence tests. Every attempt is made in each occupation to acquaint the children with the possibilities in that field of human endeavor. The disadvantages as well as the advantages are pointed out. When it is possible, trips are made to industries so that the child may see the job in actual operation in a real world. When children have completed this tryout program, conferences are held with not only each individual child but with his or her cottage supervisor. The vocational teachers meet and discuss children individually, after which each child is again called in for a second conference which usually ends in the choice of an occupation that is agreeable to the boy or girl, and which the guidance adviser feels is a satisfactory choice.

To train the child in his chosen occupation so that he could market his training when he left the institution.

To properly train children in an occupation it is necessary to have conditions approximating those in industrial plants outside the school. That means then that the machinery or equipment must be quite similar to what the child will subsequently use. It also means that the children will be working on real jobs and not just *dummy* projects. In our institution we make many things in the shops that are used in our institution. Such articles as garbage cans, incinerators, dustpans, and bookcases are stock jobs. We also repair our own shoes. Much of the office work is done by our own girls. Our switchboard is operated entirely by girls. Girls work in our hospital, our Peter Pan nursery, and in our dining rooms. Boys work in our dairy, our garden, and on our farm. This is not *dummy* work, this is actual life as it will be found anywhere. From the tenth grade on for three years until the child is graduated or discharged from the institution he receives intensive training in his chosen occupation. All of our vocational courses closely meet the requirements set up by the federal Smith-Hughes Law. The broad objectives of this law are closely approximated in our institution. To show how far we have gone in making our environment functional, we list most of the opportunities available to the child in our institution.*

To place each child in a position in the field of his interest and training.

A farmer who raises a crop is expected to take that crop to market. Unless he does this he is considered a very shiftless farmer. Educators are not as consistent when they raise a crop of valuable children. Each year schools have been training crops of boys and girls, but in very few instances have they made any attempt to market their product. A school's responsibility does not end with graduation day. This responsibility carries over until each student makes a social and economic adjustment. Possibly this lack of interest in students after they have graduated from high school has made possible the continuation of an outmoded school system. If they had followed through and tried to place graduates the inadequacy of academic training would have become apparent and resulted in a radically different school setup. In this hurly-burly industrial age children are helpless without some adult help in getting started in life.

Our Xenia institution has accepted the responsibility of placement. We do not believe that we have completed our task until our students make successful adjustments, both socially and occupationally. At times children return to the institution when they have not been able to make proper adjustments. This can be expected despite a well-planned organization and a fine educational plant. There is a variation in the ability of children. Some benefit much more in a given vocational environment than others. Usually the ones who have difficulty adjusting when they leave the institution are those who do not get along in the institution.

*For list of vocational curricular and cocurricular opportunities see next page.

Vocational Curricular and Cocurricular Opportunities

1. Acetylene welding
2. Automotive repairing
3. Barbering
4. Beauty culture
5. Blueprint reading
6. Cafeteria work
7. Camp cooking
8. Chef
9. Child care
10. Clothing
11. Commercial English
12. Commercial laundry work
13. Dairying
14. Driving cars
15. Maintenance electrician
16. Foods
17. General farming
18. General shop
19. Home employment
20. Homemaking
21. Home mechanics
22. Home problems
23. Horticulture
24. Journalism
25. Leathercraft
26. Meat cutting
27. Mechanical drawing
28. Metal (forging and heat treating)
29. Motion-picture operation
30. Nursing
31. Occupations
32. Office practice
33. Painting
34. Plumbing
35. Printing
36. Secretarial practice
37. Sheet-metal work
38. Shoe repairing
39. Shorthand
40. Storeroom keeper
41. Switchboard operation
42. Tailoring
43. Typewriting
44. Vocational mathematics
45. Waitress

Other Curricular and Cocurricular Opportunities

1. Agricultural field day
2. Algebra
3. American history
4. American legion essay contest
5. Amateur radio operation
6. Art
7. Band
8. Basketball
9. Boys' hobby fair
10. Boys' glee club
11. Boy scouts
12. Brownies
13. Camping
14. Choir
15. Cottage council
16. Cubs
17. Debating
18. Educational trips
19. English
20. 4-H Club
21. Football
22. General science
23. Dramatics
24. Geometry
25. Home review staff
26. Junior American Legion Aux.
27. Intramural sports
28. Military science and tactics
29. Music
30. Physical education
31. Piano
32. Pipe organ
33. Public speaking
34. Radio programs
35. Red Cross lifesaving
36. Religious education
37. Rifle shooting
38. Social dancing
39. Social science
40. Speech education
41. Student council
42. Students' Day
43. Swimming
44. Track
45. Youth conferences

It has been no easy assignment to place children in jobs for which they have been trained during the past six or eight years. With millions of people out of work, competition for jobs has been very keen. We have considered ourselves fortunate in placing so many children during this depression.

The success of any vocational program can best be judged by how well the graduates succeed in their jobs. We have been very much encouraged with the progress of our graduates. Quite a number of our cosmetology graduates are now successful operators in beauty shops. About 40 girls to date have taken the State Board of Cosmetology examination and only one has failed. Many of the small print shops in Ohio employ graduates from our school. The local *Xenia Gazette* has three of our graduates as linotype operators. We have several boys placed with the Crowell Publishing Company and the McCall Publishing Company. One graduate of our shoe-repairing shop is now manager in a Cincinnati repair shop with quite a large group of men working under his supervision. Many of our girls are working in homes, either as maids or housewives. During the annual reunion upon inquiry of the husbands of our girls, we find a general feeling that girls who graduated from the Home do a very creditable job of cooking and homemaking. That is the reason why we emphasize home economics for all girls, irrespective of what they choose as a specialty.

It is interesting to note that very few children who have graduated from this institution have been incarcerated in penal institutions. The percentage is much lower than for groups elsewhere. How much vocational training has influenced this is hard to estimate. We surmise it has had a great deal to do with this successful adjustment in society.

To follow up for a period of at least three years to see if a satisfactory occupational and social adjustment has been made.

The statistics showing the number of our *Home* children who are in college indicate how we follow their progress after they leave our institution. We want to know the adjustments our children are making in their postinstitution communities. Even as far back as the graduating classes of eight and 10 years ago most of the ex-pupils' whereabouts are known. Such a follow-up on graduates is desirable if we hope to improve the training for the oncoming children. Many of the changes in child care in recent years have been introduced upon the suggestion of our ex-pupils. We make it possible for ex-pupils to come back to the institution at Christmas time. We encourage their return to the annual reunion in July. When dances are held there are no restrictions that bar the ex-pupil from coming. When our investigators are in a community where ex-pupils reside these social workers call upon the former Home children to keep alive the bond between the old Home and the children of years gone by. All of these occasions make it possible for us to keep a personal relationship between the institution and the graduates. We make our children feel that this is their home and, like a child outside who goes back to the parental home, we encourage our children to come back to their Home. With so large a group there have to be some restrictions on the numbers who return on some occasions but these are not rigidly enforced. With such a feeling between the institutional administration and the ex-pupils we mutually derive benefits. The students continue to be advised by us and we learn from their successes and failures how we may improve the training for the children now with us.

Ohio Soldiers' and Sailors' Orphans' Home
Xenia, Ohio

SUMMARY ON DISCHARGE CLASSES
1930 — 1939

Year	Girls	Boys	Total Disch. Class	No. of H.S. Grads.	Per cent of Total	Entered College	College Grads.	Probable Grads.
1930	11	17	28	19	68	5	0	1
1931	24	23	47	23	49	2	0	0
1932	17	26	43	21	49	2	0	2
1933	19	23	42	20	47	4	0	1
1934	16	24	40	26	65	9	0	2
1935	13	14	27	19	70	4	0	2
1936	13	17	30	16	53	0	0	0
1937	29	31	60	44	73	4	0	3
1938	23	30	53	31	59	2	0	1
1939	47	23	70	45	64	0	0	0
Totals	212	228	440	264	60	32	0	12 (2.7%)

The figures show that during the last ten years 60% of our discharge pupils graduated from high school. Out of a total of 440 only 32 children or 7% entered college. Only 12 or 2.7% will be probably college graduates. No high school graduate within the past ten years has graduated from college. Therefore, 93% of our children have not entered college and 97.3% will not graduate

COURTESY ON THE ROAD

It has been said that "Truck drivers are the most courteous among all people who are users of our highway."

This statement may seem questionable. However, a recent survey made showed that at certain much-used intersections, 49 per cent of the private car operators and 20 per cent of the bus and taxicab operators violated some rule of courtesy, while only 5 per cent of the truck drivers were guilty of not according others proper courtesy.

The most common discourteous acts of the drivers were:

1. Stopping on the pedestrian crosswalk.
2. Making right turns short and not allowing pedestrians to cross with green light.
3. Starting so rapidly that pedestrians did not have time to reach opposite sidewalk.
4. Approaching intersection so rapidly that pedestrians were frightened into leaping forward or jumping back to sidewalk.
5. Moving from left lane into right and making right turn, cutting off other vehicle.
6. Jogging car forward or backward and making it uncertain in the mind of pedestrians as to driver's intentions.
7. Entering intersections on amber or red light or starting up before light turns green.
8. Cutting corners too closely endangering persons standing on curb.
9. Stopping too suddenly when light turns to red.
10. Blowing horn at driver who doesn't happen to start soon enough.

Drivers: Check this list for your errors and on the next survey, let's all be in the 100 per cent class in courtesy. — *Milwaukee Safetygram.*

Vocational Training and the Labor Supply Problem of National Defense*

L. S. HAWKINS[1]

Labor supply as a factor in the program of national defense became a subject of concern early in the spring of 1940. The precise nature of the problem had not been defined and discussions of the problem were characterized by conflicting interpretations and opinions. Under these circumstances a comprehensive plan of vocational training applicable to all of the ramifications of the labor supply problem was not possible since there was no core of essential facts on which all parties at interest could agree.

There were, however, segments of the labor supply problem about which enough information was available to make possible the formulation of some practical conclusions on which a vocational training program might be based.

Aside from the question of *who* was to be trained it was clear from the outset that training could take place only in line with a demonstrated demand by industries for workers in the occupations for which training was to be given. It was also understood that the need would have to be reasonably immediate — not an anticipated need for some time in the unforeseeable future.

The evident need for certain types of skilled workers made it seem desirable to provide those possessing some background of experience and opportunity to extend their knowledge and skills. For those already employed courses are provided outside of working hours. The instruction supplements the experience of the workers and is intended to offer to these workers an opportunity for advancement. Courses such as blueprint reading, shop mathematics, and industrial science offer opportunity for the workers to extend their knowledge and the shop courses to extend their skills. These supplementary courses for the most part provide for individual instruction since a worker usually comes with a rather definite idea of what particular skill or knowledge he desires to acquire.

Another segment of the nation's labor supply from which it appeared that workers in occupations essential for national defense might be drawn and made available through training was found in the ranks of the unemployed. The employment history of many of these persons showed previous experience in essential occupations or closely related occupations. Since they are unemployed and every consideration requires that they get back into employment as quickly as possible, courses offered to such persons are operated from 30 to 40 hours a week. The degree of skill possessed by these workers varies as does the length of time since employment in the occupation. It follows then that the length of time they stay in the training course varies. Even though a course is set up to operate 10 weeks it is not uncommon to have the majority of the group out of the course and in employment at the end of six or eight weeks. Ability to secure employment in an essential occupation is the training objective of these pre-employment refresher courses. Many of these persons enroll in supplementary courses after securing employment.

Some of the essential occupations are so relatively new that there are few if any unemployed persons on the public employment registers who have had previous experience in the occupation or in a closely related occupation. The aircraft occupations (manufacturing) are outstanding examples. As a consequence it has been necessary to set up the training for these occupations on a pre-employment rather than a refresher basis. It is only for single skill occupations, however, that training is offered in such courses.

Having located the segments of the labor supply in which training could profitably be undertaken, the next decision that had to be made was that of determining the source of trainees. The character of the supplementary training made the sources for this type self-evident; namely, the plants which employed persons in the essential occupations.

A logical source for trainees in the pre-employment refresher type of training is the public employment office registers. The public employment office is the government agency charged with the responsibility of referring to employers workers who, in its opinion, are qualified for employment. The United States Employment Service and the various state employment services have developed the organization and procedures to refer workers, who in a short time, could be profitably trained for immediate employment. On the one hand, the various state employment services have an intimate knowledge of employer requirements in their respective communities; on the other hand, trained interviewers have properly classified and recorded the characteristics of some considerable part of the available labor supply.

The rolls of the Work Projects Administration constituted another large organized source of trainees for the pre-employment refresher training. Technically, WPA workers are employed, but it is recognized that public interest requires these workers to be absorbed into private employment as rapidly as possible. Although all WPA workers are on the register of the public employment office, it appears more feasible to requisition trainees from this group directly rather than via the public employment service. The WPA projects, by and large, provide little opportunity for work in the metal trades or in the single-skilled occupations common to mass-production industries. It has been found, however, that there are considerable members of these workers whose experience prior to employment by the WPA was of such a nature that these workers might profitably be given refresher training for essential occupations. It is quite probable as the labor market tightens and the number of essential occupations increases there will continue to be an appreciable number of trainees coming from this source.

The Advisory Commission to the Council of National Defense early established the policy that the vocational training phase of the labor supply problem, aside from apprenticeship and other types of industry training, was properly a function of the United States Office of Education through the states. The Office of Education, and more specifically, the vocational division, brought to this phase of the problem a background of 23 years in administering federal aid for vocational education through the states.

Motivating the approach of the Office of Education was the conviction that defense training need not and should not impair the normal vocational education program functioning under the Smith-Hughes and George-Deen Acts. To the extent that federally aided vocational education is considered a long run and sound source of basic training for the future highly skilled mechanic, it would be an unsound policy to undermine it in any way. Current experience with the labor requirements of defense production seems to suggest that the highly skilled craftsmen constitute a nucleus which affects the employment of proportionately larger numbers of single-skilled workers. Apprenticeship supplemented by adequate vocational school instruction is our present best insurance for skilled workers in the future. Related instruction to apprentices is also dependent upon the functioning of the vocational education program. Curtailment or impairment of the regular program would therefore affect apprenticeship as

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[1]Chief of Trade and Industrial Service, U. S. Office of Education, Washington, D. C.

well. Conversely, extension of apprenticeship calls for an expansion of vocational school facilities to serve additional numbers of apprentices.

It is perhaps relevant at this point to summarize the principles controlling or influencing the relationship of vocational training to the labor requirements of national defense. Training was considered applicable to certain segments of the nation's labor supply; supplementary training for those already employed in occupations essential to national defense; short-unit pre-employment refresher training for unemployed persons who showed experience on which could be based training for occupations essential to national defense. Training was to be given in line with demonstrated needs for the occupations essential to national defense. The Office of Education would be responsible for training and the public employment services and the employment division of the WPA would constitute sources for trainees in the pre-employment refresher courses. Defense training would be an extension of, rather than a substitute for, the regular federal-state program of vocational education.

It has been these considerations which underlie the statutes authorizing the expenditure of federal funds for defense training and the administrative procedures set up to effectuate the purposes of these statutes. The statutes in question are: (1) that part of Public No. 668 — 76th Congress headed "Office of Education," and (2) certain subdivisions of that part of Public No. 812 — 76th Congress headed "Office of Education." Both pieces of legislation make provision for allotment of federal funds to states, by the United States Commissioner of Education, for the cost of pre-employment refresher courses and supplementary courses in occupations essential to national defense.

The administrative policies of the Office of Education with regard to defense training have been evolved with two related objectives in mind: (1) within given areas, the expansion of the nation's available labor supply to meet the immediate demand for workers in specific occupations essential to national defense; (2) the development procedures in administration and instruction which would give force to the labor supply objective.

Reference has already been made to the regular federally aided vocational education program under the Smith-Hughes and George-Deen Acts. These organic acts have established as the guiding principles of American public vocational education, that actual educational administration is a State and local function, in which the representative advisory committee plays an important part, and that the activities of the Federal Government are limited to grants-in-aid to the states, and such technical assistance to the State authorities responsible for directing vocational education, as may be necessary.

The Office of Education has adhered to this fundamental principle in administering the National Defense Training Program. Conceivably, the Office of Education in literal interpretation of the provisions of the law might have followed some other arrangement.

The state plan proposed by the state and approved by the Federal Government continues to be the basic document outlining the scope and character of the federal-state relationship. Under this plan a given state agrees to make specific provisions for such matters as administration and supervision of the program, types of training to be provided, qualifications of teachers and supervisors, adequacy of plant and equipment, and the establishment of advisory committees. In effect, then, the state plan becomes a contract between a given State Board for Vocational Education and the United States Office of Education.

In the Defense Training Program the Office of Education has in some respects been unusually insistent with the states upon meeting certain requirements not specified in the law.

1. The use of state and local representative committees.

2. Restricting training to those industries approved by the Advisory Commission and to those occupations approved by the local advisory committee.

3. Requisitioning prospective trainees for pre-employment refresher courses from public employment office and from the WPA.

The Office of Education has been at a disadvantage in pressing these matters because of the lack of a definite list of essential occupations. It cannot be assumed, however, that such a list of occupations will solve all the problems connected with the determination of the courses to be given in a local community. It frequently happens that even though the occupation is considered essential, there is no need for training for that occupation in certain communities. This may be for the reason that there is a sufficient supply of workers available in the community or for the reason that the occupation does not exist in the community. On the other hand, even though the occupation does not exist in the community, there may be neighboring communities lacking such workers. It should be noted also that courses of instruction cannot in every case be set up in terms of specific occupations.

The foregoing all leads to the conclusion that regardless of the amount of information gathered from national statistics, as helpful as such facts are, the local schools, the local advisory committee, the local employment office, and other local agencies closely in touch with the industrial affairs of the community are the ones who must make the application of national policies, facts and figures to the determination of local training programs.

It is recognized that further definition of the term "occupations essential to national defense" is the responsibility of the advisory commission. They have approved for vocational training purposes a list of industries and industrial fields in which essential defense occupations are found as furnishing a rough limitation of the fields in which training may be needed.

Aircraft — manufacturing, maintenance, and repair.
Machine tools.
Shipbuilding — manufacturing maintenance, and repair.
Automotive — manufacturing, maintenance, and repair.
Electrical.
Forging.
Boiler and heavy steel plate.
Foundry.
Light manufacturing (essential occupations only).
Sheet metal.
Woodworking (essential occupations only).
Chemicals.
Ammunition.
Ordinance, light and heavy.

These industries established the general framework within which training must take place if it is to be supported by federal defense funds. In any given community the specific occupations for which training is to be given, the numbers to be trained, and the character of the courses to be given are matters for local determination, with final authority vested in the local school boards.

The Office of Education has placed special emphasis on the need for functioning advisory committees who will give the school people active guidance in making decisions of policy with regard to defense training. In an important sense it was felt that the local advisory committees would have the same general influence on the direction of defense training, on a local level, that the advisory commission has had on the Office of Education, on the federal level.

The Office of Education has made rather specific recommendations to the states with regard to the structure and functioning of advisory committees. First, that there be equal employer and employee representation, with other members acting in a consultative capacity, but without vote when the committee is polled for recommendation; this because of the often-expressed conviction of the labor representatives that they were being outvoted by such representatives of such organizations as the chamber of commerce and the board of trade. Second, members should be *official* representatives of the representative employee or employer organizations. In this connection the Office of Education has suggested that the school authorities make a formal request of the appropriate official of the employee or employer organization, for the designation of a specific number of official representatives from which appointments may be made to serve on the advisory committee: this in order to avoid the possible criticism that the advisory committee was "hand-picked" by

the school authorities. It has been suggested further that the advisory committees be organized on state, local, and craft levels.

In general, it may be said that management and labor have not in all cases in the past had adequate opportunity through designated representatives on committees to develop a clear understanding and a sense of responsibility for the effective functioning of the program. The administrative policies of the Office of Education have evolved to the point where a provision for the organization of a functioning advisory committee is an indispensable condition for allotment of federal funds in the defense program since the objective of placement for all qualified trainees can only be fulfilled after a sound appraisal of all of the factors affecting defense training in any community. This sound appraisal, it is felt, can best be achieved through a functioning advisory committee set up along the lines suggested above.

A significant aspect of the administration of the Defense Training Program has been the development of cooperative relationships with other public agencies. The determination of joint procedure and policies have had to take place on a large scale with the United States Employment Service and the Work Projects Administration since these agencies constitute the sources of trainees for the pre-employment refresher courses.

The public employment office is the only source of trainees expressly provided for in public laws 668 and 812. However, other legislation authorizes WPA to undertake vocational training projects. By agreement with the WPA and the Office of Education 50 per cent of the total training stations available are to be filled by WPA workers wherever possible. In broad outline the procedures by which workers are referred by WPA and the various State Employment Services appears as follows: the local school authorities draw a requisition upon the WPA and the local office of the United States Employment Service for a specified number of workers. This requisition normally includes information relating to the occupation or trade for which training is to be given, the job title, the operations performed, the machines, tools and instruments used, the materials used, the special qualifications which referrals should have, and working conditions in the shop in which instruction is to be given. The Office of Education has urged the state and local vocational schools to use the "Dictionary of Occupational Titles" in requisitioning trainees in order that a uniform occupational nomenclature might better co-ordinate selection, training, and placement of trainees.

Based on the experience of the past five months there now appears to be an opportunity for the Public Employment Offices and the vocational-education forces to work out jointly a rather definite program of cooperation on federal, state, and local levels, such cooperative effort to be extended to include the securing and interpreting of all information bearing on establishment, conduct, and improvement of training as well as other relationships of training to labor supply.

If in the opinion of the school officials, subsequent experience with the person who has been accepted for training, reveals that he cannot profit by that training he may be dropped from the class.

There has been no uniform policy of selection of trainees by the schools as between communities. The process of selection has ranged from the application of an elaborate battery of tests to the informal personal interview. The Occupational Information and Guidance Service of the Office of Education and the United States Employment Service are engaged in developing plans for a wider utilization of guidance and selection techniques in connection with national defense training.

When in the opinion of the school authorities, the trainee has mastered the skills for which training has been given, the school notifies the local employment office that the trainee is ready for placement. Many states have comprehensive progress or rating cards which are transmitted to the local employment office and which explain in detail qualifications of the trainee.

The Office of Education and the United States Employment Service have agreed that the primary responsibility for placement arising out of defense training is vested with the United States Employment Service as the agency best fitted to do the job. It was recognized, however, that in a number of instances the relationship of the schools to certain employers was of such a character that the educational authorities might advantageously refer trainees for placement. For the greatest part the school-employer relationships have been built up as the result of many years' experience. In the instances where schools were performing the placement function, forms have been developed jointly by the Office, the Bureau of Employment Security, and the Work Projects Administration, on which the schools and the WPA report to the local employment office placements which they have made or which they know about. This will permit the United States Employment Service to make as complete a report on placements resulting from training, as is possible.

The Office of Education has attempted to utilize the informational resources of the United States Employment Service. In many states and local communities a representative of the Employment Service acts in the capacity of consultant to the advisory committee. The monthly labor market reports prepared by the various state employment services have been made available to the state vocational authorities. The labor market report gives fairly complete information relating to defense contracts awarded, status of the labor market, and methods which are being used to cope with a depleted labor market situation where that exists. Such information, of course, is vital to any training program which is closely linked to an objective of immediate placement. Attached to the defense training staff of the Office of Education has been a liason officer with the United States Employment Service, whose major function it is to facilitate the job of co-ordination.

On the whole, it may be said that the relationship of the Office of Education to the United States Employment Service and of the state boards to the various state employment services is one that gives every promise of becoming a permanent and desirable feature of public vocational education in the United States.

Cooperative relationships have been established with the Army and Navy. The Office of Education has attempted to act as a clearinghouse on behalf of the states for such phases of the training needs of the armed services as could be advantageously met by the state boards for vocational education. The administrative regulations provide that enlisted men may be accepted in pre-employment refresher courses without prior referral from the public employment office. In addition, the Office has advised the states on the setting up of civilian programs to meet the training needs of arsenals, air bases, and navy yards; similarly, the Army and Navy have made available to the states scrap material for instructional purposes in welding and riveting courses among others.

An integral factor in adjusting training needs to the demand for labor is equipment. By and large, the most modern and extensively equipped vocational schools have been found understandably enough in the industrial communities. To that extent, the availability of the equipment has paralleled the need for training. In a few instances, however, the character of the training has been influenced by the availability of equipment rather than by placement opportunities. Also lack of equipment has in some instances prevented establishment of needed training courses.

Purchase of equipment from funds appropriated by Public No. 668 was not authorized. However, the equipment problem has partially been solved by the passage of Subdivision (2), of the Office of Education, appropriation under Public No. 812 which makes $8,000,000 available for the acquisition of equipment in connection with the pre-employment refresher courses and the supplementary courses. A significant provision of this subdivision is that "proposals approved by the commissioner shall include provisions governing the holding of title to, and the use of, the equipment to be acquired." In line with this delegation of power the commissioner has ruled that title to equipment purchased from funds appropriated by this subdivision may be held by the appropriate State Board for Vocational Education or by local school boards. In the latter case, however, the local board must agree to make this equipment available for use at the discretion of the state board during the time of need for defense training. This makes it possible for the state board to

transfer equipment from one school to another in line with demonstrated defense training needs.

Of the total $8,000,000, minus deductions for federal administrative expenses, one half will be available to meet specific needs for new training centers or new schools caused by the establishment of new factories or plants or by unusual expansion of existing plants to produce defense orders. The other half will be made available to the states on the basis of their ability to provide training for defense workers as demonstrated by performance thus far, when by purchase of such equipment it can be shown that a definite existing need for training can be met.

Present indications are that before the summer of 1941 there will need to be a greatly extended training program, particularly for the aircraft and shipbuilding industries. Further extension of training for these industries will involve much more additional equipment than can be provided with present funds. Cost of instruction for the present fiscal year can readily be met from present appropriations.

Industrial-Arts Shop Inventory

GEO. W. DEFFENDAHL*

Most school administrators require an inventory of equipment at the close of each school year. Particularly is this true of the industrial-arts department. Teachers in this department should take inventory even though they are not requested to do so. An inventory of all shop equipment filed in the principal's office at the close of the school year relieves the teacher of the responsibility of any equipment that might be misplaced during the vacation months. If a copy of the inventory is kept it can be used to a great advantage in making out all requisitions.

A great deal of time can be saved by using the form shown herewith. I find that two students can take inventory of the entire shop equipment in one period.

In using this form, count the number of each of the items, and place the proper figure in the blank at the left.

*Baker School, Evansville, Ind.

Shop Inventory Form

Date.....
Instructor.....

Power Tools

..... Jig saw
..... Grinder
..... Drill press
..... Electric drill
..... Circle saw
..... Wood-turning lathe

General Equipment

..... Basket, wastepaper
..... Benches
..... Brushes, bench dusters
..... Brushes, floor
..... Bulletin boards
..... Cabinet, first-aid
..... Cabinet, filing
..... Cabinet, steel (for finishes)
..... Can, self-closing
..... Case, book
..... Clock
..... Desks
..... Erasers
..... Extinguishers, fire
..... Sharpeners, pencils
..... Shovels
..... Tables
..... Thermometers

General Shop Tools

..... Anvils
..... Bits, auger (square taper shank)
..... Bits, auger (round shank)
..... Bits, expansion
..... Bits, gimlet
..... Bits, screw driver
..... Calipers, inside
..... Calipers, outside
..... Cards, file
..... Chisels, cold
..... Chisels, wood
..... Chisels, wood-turning
..... Clamps, bar
..... Clamps, handy
..... C clamps, metal
..... C clamps, wood
..... Clamp, saw
..... Countersinks, metal
..... Countersinks, wood
..... Dividers
..... Dividers, wing
..... Dressers, grinding wheel
..... Drills, high-speed twist
..... Drills, star
..... Files, auger bit
..... Files, half round
..... Files, mill
..... Files, round
..... Files, slim taper
..... Files, square
..... Gauge, drill
..... Gauges, marking
..... Goggles
..... Groovers, hand
..... Hammers, ball-peen
..... Hammers, claw
..... Hammers, riveting
..... Irons, electric soldering
..... Knives, drawing
..... Knives, putty
..... Knives, sloyd
..... Mallets, rubber
..... Mallets, wood
..... Oilers
..... Pencils, burning
..... Planes, block
..... Planes, jack
..... Pliers, diagonal
..... Pliers, needle nose
..... Pliers, side cutting
..... Pot, electric, glue
..... Punches, center
..... Punches, hollow
..... Punches, pin
..... Rules, foot
..... Saws, back
..... Saws, compass
..... Saws, coping
..... Saws, hack
..... Saws, hand
..... Scrapers, cabinet
..... Scrapers, red devil
..... Screw drivers
..... Scribers
..... Shaves, spoke
..... Seamers, hand
..... Set, nail
..... Set, rivet
..... Set, saw
..... Snips, curved
..... Snips, straight
..... Stakes
..... Stones, oil
..... Squares, combination
..... Squares, bevel
..... Squares, framing
..... Squares, try
..... Vises, drill
..... Vises, metal
..... Vises, woodworking
..... Wrenches, monkey
..... Wrenches, pipe
..... Wrench set, end
..... Wrench set, socket
..... Wrenches, miscellaneous
..... Yardsticks

Drawing Equipment

..... Boards, drawing
..... Compasses
..... Compass, blackboard
..... Curves, irregular
..... Punch, paper
..... Scales, architect
..... Scissors
..... T squares
..... Triangles 45
..... Triangles, 30–60

Books

..... Drawing
..... Electricity
..... Bench metal
..... General metal
..... Home mechanics
..... Sheet metal
..... Miscellaneous

Periodicals

..... *Deltagram*
..... INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

Method of Storing Equipment and Supplies

..... All polish surfaces of machines covered with heavy oil or grease
..... All electrical switches turned off
..... All extension-cord plugs removed from the sockets
..... All polished surfaces of tools covered with heavy oil or grease
..... All paint, varnish, and shellac brushes cleaned
..... Can containing finishing materials tightly covered
..... All supplies orderly stored
..... All tools sharpened
..... Annual requisition completed
..... All keys turned into office

An Accounting Technique for National Defense Classes

HAROLD J. VAN WESTRIENEN*

The administration of the current program of Vocational Education for National Defense has presented directors of vocational education with new problems of accounting. The local expenditures must be kept within rigidly controlled budgets to avoid deletions from reimbursement requests. The procedure devised by the writer is submitted with the thought that some directors may still be troubled with the problem of keeping within the budget allowed for the operation of each course conducted under this program.

Although there are no doubt many different state procedures for regulating the costs of courses operating under the National Defense Act, enough similarity exists to make the following technique applicable with slight alterations where necessary. In Michigan, a separate contract must be submitted for each course. The names of each teacher, toolroom attendant, janitor, and other personnel must be included, along with the salary for the period of the course. Allowance for instructional supplies, maintenance of equipment, heat, light, power, and other items, must also be estimated and submitted on the contract.

At regular periods moneys actually expended against these budgets are vouchered back to the State Board of Control for Vocational Education. The staff at the state office carefully audits these vouchers, and if found correct, payments are authorized. The main concern of the director is to see that no single item on each contract is overdrawn, for any amount in excess of that allowed is deleted from the payment and involves a loss to the school district. With several courses in operation this becomes a major job of accounting, and, unless a simple and accurate system is adopted, an unwarranted amount of time must be consumed by the clerical staff in the accounting procedure.

The form accompanying this article has been found to be simple to operate. Its use should relieve the director of concern over his budget balances, and result in less work on the part of auditors in the state departments.

How to Use the Form

One copy of the form should be filled out for each course after the contract has been submitted to the State Board for Vocational Education and approved by that office. The contract number, course code number, inclusive dates the course is to operate, name of course, school in which the course is conducted, and the time the class meets, should be entered in the spaces at the top of the form. The budget allowance for each item in the budget is then entered, along with the names of teachers, tool-crib boys, janitors, and the like. The data entered on the accompanying form is purely fictitious and is merely for illustration.

As vouchers are submitted for reimbursement, the date and amounts requested are entered under the proper column and then deducted. This will show the balance still available. The procedure is repeated as new amounts are submitted from time to time. In this manner the director can be kept in constant touch with the amount still available, and regulate expenditures accordingly. By comparing expenditures of similar classes, taking into account class load, an adequate trainee unit cost can be established as a basis for future contract writing.

Contract # 5432
Code PR-Mto-2741
From 2/4/41 to 4/15/41

Hamtramck Public Schools
Department of Vocational Education
BUDGET AND LEDGER FOR NATIONAL DEFENSE ACCOUNTS

Course Machine Tool operation
School Vocational
Time 12:00 - 6:00 P.M.

Service & Dates		(21) Instruction Salaries Teachers, Toolcrib Boys, etc. Jones		Smith			(22) Inst. Supplies	(23) Maintenance Salary	Supply	(24) Operation Heat	Light	Power	Janitor	(25)	(26) Totals
Budget	Per Week	75.00		18.00			40.00	4.00	10.00	8.00	1.50	7.00	5.00		168.50
	Per Month	300.00		72.00			160.00	16.00	40.00	32.00	6.00	28.00	20.00		674.00
	Total	750.00		180.00			400.00	40.00	100.00	80.00	15.00	70.00	50.00		1,685.00
3/5/41	Voucher Amount	300.00		72.00			150.00	—	25.00	32.00	6.00	28.00	20.00		633.00
	Balance	450.00		108.00			250.00	40.00	75.00	48.00	9.00	42.00	30.00		1,052.00
	Voucher Amount														
	Balance														
	Voucher Amount														
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	Balance														
	Voucher Amount														
	Balance														

Budget and ledger form

The longer on this earth we live and weigh the various qualities of men, the more we feel the high, stern-featured beauty of plain devotedness to duty. — *James Russell Lowell.*

Character is in the long run the decisive factor in the life of individuals and nations alike. — *Theodore Roosevelt.*

*Director Vocational Education, Public Schools, Hamtramck, Mich.

Initial Steps in Planning Shops

ROGER J. WEAVER*

Industrial and vocational education has made such rapid strides during the past 20 years that instead of a school offering only traditional woodworking, today we find schools offering many different courses. There are at present more than 80 different types of shopwork being offered in the United States. A study of standards already established shows, however, that many things are common to all shops. The problem of planning a shop then is not a matter of just sitting down and drawing a floor plan and saying: "This is the ideal shop floor plan." The following list of steps in planning is therefore submitted to help those confronted with the task of planning new school shops.

Visits to new shops, discussion of shops with the instructors employed in them, careful study of all of the literature on the subject, listing of items set up as standards for shops for the different grade levels, and a number of years of experience in various shops have been the basis for making out this list.

The list of steps and the check list are not without fault, they are merely offered for what they may be worth. Some of the items may seem to be out of place, but they are listed because they represent things that have been overlooked in buildings now in existence. In one of the large cities of the United States, for instance, heating units were placed between wood lathes and the windows. When the fan in these units is in operation it blows chips from the lathe back into the eyes of the person operating the lathe. This is dangerous and could be avoided by use of a different type of heating device.

The discussion which follows is of necessity general in its nature. It deals almost entirely with the planning of individual rooms instead of the building as a unit because it is assumed that the architect and the school officials can best decide what type of building is most suitable for their own particular situation.

The amount of money available for new equipment, style of old equipment, type of pupil (adult night school or high school only), course content (radio, house wiring, industrial electricity), the number of pupils to be accommodated, all are factors which must be considered in preliminary planning of the school shop.

Step 1. Survey community securing information showing: number of places of employment in the community by groups according to industry or type; list various occupations represented; list number and sex of persons employed, also whether they are engaged in skilled, semiskilled, or unskilled labor; learn what occupations are seasonal and determine period of greatest activity; try to determine the number of people each trade or type of occupation can absorb each year; and learn what type of work is most needed. All of this information must be known before one can determine how the school shop can best assist the community in preparing its people to serve the employers and themselves.

Step 2. Hold conferences with personnel managers and factory superintendents, to pave the way for part-time students and apprentices; and get their reactions on how the school can better its service. Industry will frequently assist the school in securing equipment. Get the same type assistance from labor organizations and groups.

Step 3. Determine what type of pupil the school will serve. Adult evening school will require different equipment, and probably different shop arrangement.

Step 4. Determine courses to be offered. Course content and method of instruction affect building plans. Example: An electrical class may require model houses or rooms for house-wiring experience; or they may want to study electricity, not as part of a trade, but as part of a general electrical course, and for that reason may want to use panels hung on metal supports built in the walls. In a course of industrial electricity, special concrete bases for motors may be required.

Step 5. Use pieces of heavy paper cut to a convenient scale to represent the amount of floor space each machine or bench, desk or wash fountain may require. Place the pieces of paper on a floor plan sketched to the same scale and adjust until aisle space safety zones, and machine locations are satisfactory. Consider the fact that machines should be so located that flying chips or turnings will not endanger the operator of another machine. The proper routing of materials through the shop from one of the machines to another without annoying other students who are at work is essential. Adequate lighting and the removal of projects from the shop are other factors that must be considered, as well as the fact that no pupil in the shop should be so located that the instructor cannot easily see him at any time. Pilasters often prevent this.

Step 6. Proper location of auxiliary rooms such as, office, tool crib, project rooms, glueing and finishing room, lumber storage rooms, supply or stockroom, darkroom, and the like, must also be considered and studied.

Step 7. After the maximum size of the class to be instructed and the amount of floor space required for the items considered in Step 5 have been determined, the floor space for the class should be calculated by using the area and amount of cubic feet of air to be allowed per pupil. The figures thus obtained should then be checked by cost per cubic foot for construction, ability, and willingness of the community to pay.

Step 8. Prepare sketches for the floor plan showing locations of each machine, bench, aisle, door, auxiliary room, water connection, gas connection, electric outlet (stating type of current, phase, voltage and amperage), space for assembling large projects, built-in cabinets, bulletin boards, blackboards, mezzanine floor, vents and stacks for removal of lead or gas fumes, overhead hoists attached to the ceiling, and the capacity of the hoist, doors and direction of swing, concrete machine bases, and the windows.

Step 9. Check your plans with a copy of standards for school shops.

Step 10. Consult the architect and present your ideas to him. Secure his sketches and check them with a check list carefully to avoid omissions and errors.

Check List

1. Do the course offerings fit the local situation?
2. Will the shops, as they are planned, enable the instructors to use methods of instruction suitable with classes of maximum size?
3. Is the floor and the wall around wash fountains adequately protected against water?
4. Are wash fountains adequate for classes of maximum size?
5. Are toilet facilities readily accessible to all shops?
6. Are toilet facilities adequate for the number of pupils to be accommodated?
7. Are water and sewer connections along the inside wall where they may not be in danger of freezing and where they may be most economically connected?
8. Are all classroom walls between classrooms of the nonsupporting type?
9. Is automatic temperature control provided?
10. Is a dust-removal system provided?
11. Are all stacks and flues or vents shown on floor plans?
12. Is the inside dimension of each clearly marked?
13. Are the heating units so placed that they will not blow chips and dust into the operator's face who works on a near-by machine?
14. Are all shops using gas furnaces, forges, and lead-melting pots provided with vents for the removal of fumes?
15. Will the ventilation system provide 12 cu. ft. of fresh air per minute, per square foot of floor area?
16. Has provision been made for the fresh-air intake opening to be so located that only clean fresh air, free of odors or fumes, may be brought into the building?
17. Is any provision made for filtering the air or washing it?
18. Is there an automatic control of humidity?
19. Will sounds be carried through the building by the ventilating ducts? Have steps been taken to prevent this?
20. Have you provided for 50 sq. ft. of floor space per pupil?
21. Is 200 cu. ft. of air space per pupil provided?
22. Have you provided window area equal to one fourth floor space?
23. Are all windows provided with shades?
24. Are the windows easily cleaned? Easily reglazed?
25. Will upkeep cost of windows be low?
26. Are windows of a type which operate easily?
27. Are the exits of the auto shop, machine shop, and the print shop readily accessible to the service drive? Delivery of heavy machin-

*George Washington High School, Indianapolis, Ind.

ery and supplies also must be considered before building?

28. Are provisions made for ceilings which will support chain hoists? The capacity of such hoists should be made known to the architect as well as where they are to be located.

29. Are 2 exits provided for the auto shop, so that cars can be readily routed through the shop?

30. Are the exits of suitable height and width to enable delivery or removal of any machine or project that is to be built.

31. Are doors provided with checks, kick plates, and rustproof hardware?

32. Are exit doors provided with good tumbler-type cylinder locks?

33. Are outside doors provided with fire bolts? Do they swing out?

34. Are classroom doors provided with glass in the upper half in small panes? Clear glass?

35. Do all classroom doors open into the corridors?

36. Do they open without interfering with corridor traffic?

37. Are doors on opposite sides of the corridor staggered?

38. Are display cases built into the breather walls along the corridors?

39. Are these cases provided with sliding glass doors in the front? Are locks provided?

40. Are detail drawings of each case provided?

41. Are corridors of adequate width? Twelve feet is considered standard.

42. Are corridor floors and ceilings acoustically treated?

43. Are the floors of durable, resilient, easily cleaned material?

44. Have the types and colors of wall surfaces been specified for each room?

45. Is sound insulation provided in the classrooms and in the shops?

46. Will wall and ceiling maintenance costs be low?

47. Are detailed drawings of each built-in shelf, cabinet, piece of equipment, or fixture available?

48. Is the location of each clearly shown on the plans?

49. Are lights on the side of the room opposite the windows of greater intensity than those located elsewhere.

50. Are they on separate circuits? To put in separate circuits may cost more at first but is cheaper in the years to follow because it permits use of light where it is most needed.

51. Is the light intensity and type of lighting fixture specified for each room? Fifteen to twenty-five foot-candles 30 in. from the floor is adequate. Preferably without shadows.

52. Have sufficient electrical outlets been provided and at proper places in the various rooms to permit use of lights or portable machines wherever they may be needed?

53. Are individual lights provided for each machine at which close, fine work may be done?

54. Are circuit breakers provided instead of fuses?

55. Are they located where the instructor may quickly and easily turn them on or off in case of necessity?

56. Is the drafting room provided with indirect lighting of sufficient intensity for night use?

57. Are all light switches conveniently located in the room?

58. Are the light switches for each room in the room itself?

59. Are all electrical outlets marked, showing location, voltage, amperage, type of current, and number of phases?

60. Are ducts laid under the floors of floor of room for electrical conductors so that outlets are provided every few feet as is provided by use of General Electric ducts with flush floor plates? Even though wire isn't inserted until needed, this provision makes for greater flexibility in the use of rooms.

61. Is each shop provided with a power control panel and circuit breaker where it is readily accessible to the instructor?

62. Are all machines individually powered?

63. Is each electrical outlet for power machinery clearly marked showing location, voltage, amperage, type of current?

64. Are all rooms, where gas or explosive vapors may be found, provided with explosive-proof electrical fittings, switches, and motors?

65. Are all gas burners provided with shutoff valves in the supply line for use in emergency?

66. Are devices provided which will prevent flash backs into the gas pipes, thus preventing explosions in the pipes or meter?

67. Are the walls and ceilings, as well as the floors, in the vicinity of forges, furnaces, and molding floors of fire-resistant material?

68. Are the water pipes provided with emergency shutoff valves in sufficient number so that the least inconvenience will result?

69. Are the floors around machines provided with nonslip surfaces?

70. Are concrete machine bases shown on the floor plans?

71. Are detail drawings of each machine base provided with center to center distance between studs shown? Size stud?

72. Is the location of each machine such that it will receive the best possible light both natural and artificial? Will the sunlight be likely to bother a student at work at any time of day or year?

73. Will chips, turnings, borings, or pieces of stock from one machine endanger or annoy the operator of another?

74. Have safety zones been provided? A zone around a machine in which only the machine operator is permitted.

75. Will open space around each exit comply with the fire laws?

76. Will students be able to pass along the aisles without annoying students at work at the benches?

77. Are aisles of sufficient width to permit easy movement of materials about the room?

78. Has consideration been given to the length of pieces of stock to be used on each machine? Will such stock extend so far as to interfere with others using other machines near by?

79. Can materials, such as lumber, be brought into the shop and freely moved to its proper place.

80. Has space been allowed around tool cabinet and toolroom windows to accommodate several pupils at once?

81. Is each shop so arranged that the instructor will be able to see all boys at all times.

82. Has the floor for each shop been selected as the one best suited for that type of work bearing in mind the problem of upkeep, cleaning ease, fire safety, waterproofness and tool damage?

83. Do specifications call for and specify clearly the type of floor and grade of material to be used.

84. Is storage space provided for supplies for each shop?

85. Is provision made for storage for shop garments, towels, and the like?

86. Does each shop have a clear space sufficiently large enough for assembly of large projects?

87. Are spaces provided in shops for class demonstrations and discussions?

88. Does plan show location of bulletin boards and blackboards for each shop? Blackboard standards call for 20 by 36 sq. ft., 36 in. minimum width, mounted with firm backing, perfectly butted, smooth joints.

89. Are details of each available and included in drawings and specifications?

90. Is each shop provided with electric clock, class bell, fire signal, and public-address outlets?

Auxiliary Rooms

Toolroom

91. Is the toolroom of standard size (10 by 12 ft.)?

92. Is office separated from shop by a glass partition?

93. Is the office provided with some means of ventilation?

94. Is it provided with both natural and artificial light of adequate intensity?

95. Is it provided with electric outlets?

Tool Crib

96. Is toolroom provided with wire grill door and window which can be locked?

97. Is the toolroom adequately lighted?

98. Are detail drawings of built-in toolroom shelves and cabinets available?

Project-Storage Room

99. Are separate project-storage rooms provided for each class using a given shop? Adequate floor space is 7 by 7 ft. with a 13-ft. ceiling.

100. Can each be locked?

101. Are detailed drawings of built-in shelves to be used available?

102. Has a 31-in. clear space above the floor been provided beneath the shelves in each project room for storage of partly assembled projects.

103. Has a rolling or sliding ladder been installed to store materials on higher shelves?

104. Are project-room doors of adequate size? The standard is 3 by 7 ft.

Glue Room

105. Is the glue room separated from the shop by a glass partition?

106. Has an electric outlet been provided for the gluepot?

107. Is the floor of a type that is easily cleaned?

108. Has the room been provided with a source of heat supply which will maintain temperatures of 80–90 deg. F.?

109. Have built-in wall racks for hanging clamps been provided?

110. Has it been made clear to the architect that the ceiling of the tool crib, glue room, and the finish room will form the floor for a mezzanine floor, and that it is to have a steel railing along the front? Ceilings of the rooms mentioned above are only 6½ ft. high.

111. Has a built-in zinc or stainless-steel covered table of 30-in. height and about 20-in. width been provided along one side of the glue room?

112. Has a stair or ladder with handrail been provided to facilitate the use of the mezzanine floor?

113. Can the glue-room walls be kept clean easily?

Finishing Room

114. Is the floor of the finishing room easily cleaned?
115. Are the walls of the finishing room of a material which will be easy to clean?
116. Will ducts provide dust-free ventilation?
117. Will it be possible to maintain a temperature of 80–90 deg. F.?
118. Have your plans included a fan for fume removal?
119. Are doors, walls, ceiling, floor, and windows of fireproof materials?
120. Is adequate light, both natural and artificial, to be available?
121. Is there to be a glass partition between the shop and the finishing room?
122. Are explosion-proof fittings specified throughout the electrical system to be installed in the finishing room?
123. Do all doors open outward?
124. Are all of the finishing room doors to have fire bolts?
125. Does the spray booth comply with fire-insurance regulations?
126. Is provision made for metal-covered shelves and metal storage cabinets built in for supply storage?

Lumber-Storage Room

127. Is the lumber-storage room equipped with fire doors. Are floors, ceilings, and walls of fireproof construction throughout?
128. Can lumber be brought from service drive directly into the storage room?
129. Can long boards be conveniently taken from the room into the shop?
130. Is the lumber room located so that lumber may be brought directly from the lumber room to the power saw and other shop machinery?
131. Is ventilation provided?
132. Can this storage room be heated above regular shop temperature?
133. Which type of lumber storage will be used; horizontal or vertical?
134. A vertical storage space must be long enough to accommodate standard lengths of lumber. Is the room to have a high ceiling so that this lumber can be properly stored?
135. Horizontal storage requires a long room. Is the room long enough for standard lengths of lumber?
136. Have plans been made to build in a metal rack for the lumber storage? Vertical storage is most efficient; it enables you to use a narrow room and most of the space overhead.
137. Will steel pipe of adequate size built into the walls be so placed that it will support lumber stored vertically?

Drafting Room

138. Is the drafting room located near the shops?
139. Are electrical outlets provided for blueprint machine, projection lantern, and other electrical equipment?
140. Does the natural light enter this room from the rear and left of the tables or benches?
141. Is the lighting to be indirect and of such intensity that the light intensity will be 40–50 foot-candles at each drawing board and other working surfaces?
142. Are water connections provided for wash sink and fountain?
143. Will a darkroom be available for handling light-sensitive papers?
144. Is there a sewer connection provided for drains?
145. Are colors and types of wall and ceiling surfaces specified?
146. Are corkboard surfaces provided for drawing exhibitions?
147. Is the blackboard space adequate?

Automotive Shop

148. Are water connections provided at wash rack as well as for use in cooling live motors? The wash rack must have a good sewer connection for draining radiators as well as for using the wash rack. Live motors must also have a drain for water used in cooling them, and provision must be made for removal of exhaust gases.
149. Have enough electrical outlets been provided in the most advantageous locations to permit usage of portable machines?

Testing and Tests

KEY FOR ARCHITECTURAL DRAWING TEST

R. J. Watson,
South Hills High School, Pittsburgh, Pa.

The following list may be used for checking the architectural test which appeared on page 207, May, 1941, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION:

1. Roof
2. Chimney-masonry, cap, etc.
3. Flashing
4. Attic vent. attic room
5. Exterior trim
6. Wallboard, plaster, etc.
7. Closet space, shelves, etc.
8. Outlets and wiring
9. Flooring-finished lumber, etc.
10. Plumbing and fixtures
11. Gutters, downspouts
12. Kitchen equipment
13. Paint, wallpaper, decorations, etc.
14. Built-in bookshelves, etc.
15. Fireplace, mantle, flue, etc.
16. Joists and subflooring
17. Interior trim.
18. Grading and landscaping
19. Recreation room, laundry
20. Heating plant
21. Rafters-studding
22. Roof sheathing
23. Dormers
24. Doors and hardware
25. Weather stripping
26. Electric fixtures
27. Roofing, shingles
28. Sheathing and insulation
29. Window frames and sash
30. Blinds, shutters
31. Exterior walls
32. Garage, workshop, etc.
33. Porch bench, transom, etc.
34. Stairway, treads, rails, etc.
35. Steps, bricks, wood, tile, etc.
36. Walks and drives
37. Foundation walls.
38. Basement floor
39. Drain tile
40. Footing

TEST FOR THE PRINT SHOP—TECHNICAL STUDIES

R. Randolph Karch,
Principal, Printing High School, Cincinnati, Ohio

Final Mastery Test

Questions may be either true of false or require one-word answers. Time is limited to one hour. Number after questions refer to sections in *Printing and the Allied Trades* which deal with the subject matter. Should the student jot down these numbers on his test sheet, he will be able to check against wrong answers when the test sheet is returned.

Return this test sheet with your answer sheet.

I

1. Printed matter other than books was not economically possible until the year ..... 11.
2. One person out of each ..... of the population of the United States is employed in some way in the graphic arts. 12.
3. There are about ..... printing establishments in the United States. 12.
4. Three main divisions (processes) in the graphic arts are: ..... 13.
5. The largest process is divided into three groups with reference to the kind of work done: ..... 13.
6. In silk-screen printing, the screen is always hand cut. 13a.

II

7. American type-high material measures exactly ..... 15.
8. Type alloy contains three main ingredients: ..... 16.
9. Serifs are that part of the face that extends over the side of the body. 17.
10. The shoulder is the top of the type below the face. 17.
11. Nicks always tell the font of a type. 17.
12. Ligatures are combinations of certain letters to keep that combination from breaking parts of the letters. 18.
13. Bodoni is an old-style letter. 20.
14. Caslon is a modern letter. 20.
15. A nonpareil is six points. 24.
16. To find a type size, the face and shoulder are measured. 25.
17. Six-line wood type is the same size as 84-point type. 27.

III

18. Leads can be either 1, 2, or 3 points thick. 31.
19. Laborsaving fonts of lead are those which are cut to size by the printer. 31.
20. A 24-point em quad measures two by two picas. 34.
21. The standard space for use between

words in hand composition, generally, is the ..... space. 34.
22. There are 6 en quads in a three em quad. 34.
23. Reglet is used generally for blanking out large spaces. 35.

IV

24. When set for composing 30 picas wide, the graduated composing stick is exactly this measure. 40.
25. Making each line of type the same width is called "spacing." 41.
26. A three-em plus a four-em space is slightly smaller than an en quad. 44.
27. Spacing is always mathematically uniform between words. 44.
28. When quadding out a line, the smaller spaces and quads are placed at the end of the line. 47.
29. Type lines are read from left to right, upside down. 48.
30. First quotation marks are usually made by setting two apostrophes nick down. 52.
31. Roman numerals always take the capital letters. 63.

V

32. When facing the closed end of a galley, a type form in that galley is tied up so that the string is tucked in at the far right-hand corner of the form. Fig. 34.
33. The correct name for a proof-press inking roller is ..... 68.
34. Forms are rubbed with a dry rag after proofing. 68.
35. The same planer is used for stone proofing as is used for planing down forms. 69.
36. The copyholder always reads to the proofreader. 71.
37. Few corrections in hand matter can be made without taking the type from the forms and placing it in a stick. 73.

VI

38. Distribution of several lines of type is done by holding the stick in the left hand, and using the right hand for the actual distribution. 78.
39. It is necessary to compare the nicks in distributing monotype type into cases. 78.
40. Leads and slugs are placed indiscriminately in a pile for distribution. 80.

VII

41. Monotype borders are cast in units and in strips. 83.
42. Brass rule is more durable than linotype rule. 85.
43. A made-up border is the skeleton of the form. 87.

VIII

44. Contrast is the keynote of display. 93.
45. Bleed pages are those with a small margin on the page. 102.

IX

46. One of the most popular sizes of envelopes is the No. ..... size. 115.
47. Most popular size of letterhead is the ..... inch size. 118.
48. Die-cut cards are usually used in printing calling cards. 124.
49. Billheads are often bought cut to size and ruled. 129.
50. Daily newspaper ads are sold by the ..... line. 167.

Using a six-point column rule and a 12-pica column:

51. A three-column ad is how wide? 168.
52. A six-column ad is how wide? 168.
53. An eight-column ad is how wide? 168.
54. Colored lines on blank books, index cards, etc., are usually done in a ..... machine. 175.

X

55. Sixty-point may be run on the Linotype and Intertype. 184.
56. Five-point matrices can be used on the A-P-L. 187.
57. Type for cases can be made on the A-P-L. 187.
58. The Teletypesetter can cast lines up to only 24½ picas wide. 188.
59. The Ludlow operator picks up one mat at a time when setting the smaller sizes. 189.
60. All Ludlows cast 22½-pica slugs. 190.
61. Words can be formed in Ludlow mats up to 96 point. 190.
62. With special attachments, the Elrod can cast border in fancy designs. 191.
63. The Monotype keyboard contains four alphabets. 194.
64. A Monotype controller ribbon is punched on the caster. 195.
65. Copyfitting can be done on the Monotype by adding a small amount of space between letters. 197.
66. Lines may be justified up to 60 picas wide on the Monotype. 197.
67. Monotype quads are often used as base for cuts. 197.
68. No more than about 2000 faces are available on the Monotype. 197.
69. The Monotype Material Makers can cast one-point leads. 197.
70. The Type and Rule Caster Monotype can cast type from five to 42 point. 199.
71. The Thompson can cast some letters at a speed of 250 characters per minute. 200a.

XI

72. A chase size is determined from its inside measurements. 202.
73. Sheetwise forms are backed up with a different form. 209.
74. Each section of a book, in printing, is called a ..... 215.
75. The printer's term for page numbers is ..... 215.

XII

76. A Chandler and Price press is a clamshell platen.
77. A Thompson press is a "sliding platen" press.
78. Make-ready placed behind the form is called ..... 224.
79. Make-ready placed directly under an electrotype plate is called ..... 226.
80. Make-ready placed in the packing is called ..... 225.
81. A drum cylinder makes one revolution when printing a sheet. 232.
82. A Miehle Vertical is one type of stop-cylinder press. 234.
83. Perfecting presses print on one side of the sheet only. 235.
84. Rotary presses always print from a roll. 236.

XIII

85. A 50- to 85-screen half tone will print well on newsprint stock. 242.
86. A 150-line screen half tone will print well on bond. 242.
87. Directions to an engraver should be written on the back of the photograph. 243.
88. Lines are drawn on the photograph to show cropping marks. 243.
89. Photos should be rolled — never delivered flat to the engraver. 243.
90. Rubber plates are always hand cut. 246a.

XIV

91. Electrotypes are made from paper matrices. 248.
92. Bad corners on a job can be joined in electrotyping. 250.
93. Maps and rule forms are often made by the wax engraving process. 254.

XV

94. Letterpress and lithographic ink is the same. 255.
95. Enameled stock requires more ink than does antique stock. 257.
96. Four-color printing is done with opaque inks. 264.

XVI

97. Copperplate printing is the intaglio process.
98. Thermography is done with a female die.

XVII

99. Collotype screens are very fine in texture. 278.
100. All gravure presses feed from a roll. 277.
101. This mastery test was, in my opinion: (*a*) very easy, (*b*) easy, (*c*) average, (*d*) hard, (*e*) very hard.

FINAL SECOND-TERM TEST IN GENERAL METAL

W. H. Bowers,
High School,
Tuckahoe, N. Y.

Part I — Related Work

Some of the following statements are true, some false. If you think the statement is true place a *T* after it; if you think the statement is false place an *F* after it. Do not guess, as you can't pass this examination in this manner. The passing grade is 70 per cent. Your score is 100 per cent if you answer all statements correctly.

1. Many persons have been permanently injured by using the engine lathe incorrectly. ....
2. Loose neckties, long sleeves are often causes of accidents while working on a lathe. ....
3. The drill press is a safe machine if properly used. ....
4. Both large and small holes are drilled at low speed. ....
5. Always hold the work securely in your hand when using the drill press. ....
6. Injuries are rare to students using the hand operated machines. ....
7. The bar folder is always operated at low speed. ....
8. When buffing on a lathe hold your work loosely. ....
9. Buffing should be done at about 3600 revolutions per minute. ....
10. It is dangerous buffing articles that have large holes in them. ....
11. Handle hot buffed articles with gloves or rags. ....
12. The crank of a bicycle and the crank on an engine work in similar fashion. ....

13. Torque is that which produces or tends to produce motion. ....
14. One horsepower is the ability to lift 500 lb. ....
15. The horse was used as the source of power in early mechanical devices. ....
16. One horse was always able to furnish sufficient power for all jobs. ....
17. One cylinder always develops enough power to do the work required. ....
18. To increase the power in automobile engines other pistons are added. ....
19. The horsepower developed in the automobile engine propels the rear wheels only. ....
20. Gasoline engines are made in two sizes only. ....
21. An engine with 1200 horsepower is used in aircraft. ....
22. Most automobile engines develop 200 horsepower. ....
23. The ability of an engine to do work is dependent upon the horsepower developed. ....
24. A single cylinder engine has only a certain capacity for work. ....
25. The bore of the cylinder and the stroke of the piston are the same on all cars. ....
26. All engines are rated by bore and stroke. ....
27. There are three methods generally used for rating horsepower. ....
28. Automobile engines are spoken of as four-cycle engines. ....
29. A stroke is two complete down and one complete up movement of the piston. ....
30. There are five events in the automobile engine cycle. ....
31. On the first stroke of the cycle air and fuel are drawn in through the carburator. ....
32. The compression of the fuel occurs on the first upstroke of the piston. ....
33. The correct order of the four strokes is as follows: intake, power, compression, and exhaust. ....
34. The power developed by automobile engines is the same at all speeds. ....
35. The transmission receives its driving power from the engine, through the clutch. ....
36. The transmission transmits power to the front axle. ....
37. The automobile engine can be set in motion only by means of the starter. ....
38. It is the duty of the ignition system to have a hot spark delivered to the spark-plug points. ....
39. Battery ignition is in use in all modern makes of pleasure automobile vehicles. ....
40. The micrometer resembles a scriber, in appearance. ....
41. Micrometers are also made for taking inside measurements. ....
42. It is possible to find the diameter of a hair with a micrometer. ....
43. The micrometer is a very expensive tool. ....
44. The micrometer is a necessary tool to any machinist. ....
45. Threading is the process of cutting threads on rods or in drilled holes. ....
46. There is only one standard thread in use. ....
47. A tap is used for cutting a thread on a rod. ....
48. There are four flutes on a tap. ....
49. Three taps are generally used when tapping a hole. ....
50. When selecting the tap drill, the correct size must be used. ....
51. A tap wrench resembles a caliper in appearance. ....
52. A few drops of oil should always be placed in the hole to be tapped. ....
53. The tap is moved from the right to the left. ....
54. The tap should be removed occasionally to remove the chips. ....
55. The chief difference between steel and iron is in the carbon content. ....
56. Pig iron contains about 10 per cent carbon. ....
57. Steel has less than 2 per cent carbon. ....
58. One of the simplest methods of making steel is called the Bessemer process. ....
59. It is accomplished by blowing air through melted pig iron in a Bessemer converter. ....
60. The Bessemer converter consists of a round-shaped steel vessel about 50 ft. high. ....
61. The top of the converter is pierced with a number of holes. ....
62. The converter is sometimes tilted when being charged. ....
63. When the carbon is burned out, the flame rises sharply. ....
64. The Bessemer process is used chiefly for the manufacture of low-carbon steel. ....
65. Bessemer steel is used in the manufacture of nails, wire, and shafting. ....
66. Gas is used for fuel when operating an open-hearth furnace. ....
67. The exhaust gas is not allowed to escape in the open-hearth furnace. ....
68. The open-hearth furnace is quicker than the Bessemer. ....
69. The product obtained from the open-hearth furnace is inferior to that obtained from the Bessemer. ....
70. Steel rails and machinery parts are made from open-hearth steel. ....
71. The gauge used in measuring wire and sheet metal is the same. ....
72. The sheet-metal gauge resembles a micrometer in appearance. ....
73. The sheet-metal gauge is adjustable. ....
74. Only one standard sheet-metal gauge is in use. ....
75. The Brown and Sharpe gauge is considered standard. ....
76. The price of band iron is 25 cents per foot. ....
77. Band iron is more expensive than brass. ....
78. Galvanized iron is cheaper than copper. ....
79. A 6-in. pewter disk is worth about 35 cents. ....
80. Copper is more expensive than nickel silver. ....
81. Jeweler's saw blades are worth 10 cents each. ....
82. Emery cloth costs approximately 5 cents per sheet. ....
83. Turpentine is more expensive than varnish per gallon. ....
84. The engine lathe is a very costly machine. ....
85. In modern industry labor is classed as skilled and unskilled. ....
86. The closed shop employs union men only. ....
87. The labor unions started in the year of of 1932. ....
88. The workman's compensation law is a valuable legal safeguard to the men in industry. ....
89. All forms of iron and steel used commercially contain impurities. ....
90. The entire social life of this nation has been changed by modern automobile transportation. ....
91. The auto engine may become hot if one of the fan blades is out of alignment. ....
92. Spark plugs should be cleaned every 10,000 miles. ....
93. It isn't necessary to remove the spark plugs when cleaning carbon from the auto engine. ....
94. A leaky valve, or a valve that needs to be ground is a reason why some auto engines lack power. ....
95. Use turpentine and brush to clean the motor in an automobile. ....
96. When relining brakes it is necessary that the rivets should be flush with the surface of the lining. ....

Key

1. F	25. T	49. F	73. F
2. F	26. T	50. F	74. T
3. F	27. T	51. T	75. F
4. T	28. T	52. F	76. F
5. F	29. F	53. T	77. F
6. T	30. F	54. T	78. T
7. T	31. F	55. T	79. F
8. F	32. T	56. F	80. T
9. F	33. F	57. T	81. T
10. F	34. F	58. T	82. F
11. T	35. T	59. F	83. F
12. F	36. F	60. F	84. F
13. T	37. F	61. F	85. T
14. F	38. T	62. T	86. T
15. F	39. T	63. F	87. F
16. T	40. T	64. F	88. F
17. F	41. F	65. T	89. T
18. T	42. T	66. F	90. T
19. F	43. T	67. T	91. T
20. F	44. T	68. T	92. F
21. T	45. F	69. T	93. T
22. F	46. T	70. T	94. F
23. T	47. F	71. T	95. T
24. F	48. F	72. T	96. T

MECHANICAL-DRAWING TEST

W. C. Hjertstedt,
Lane Technical High School, Chicago, Ill.

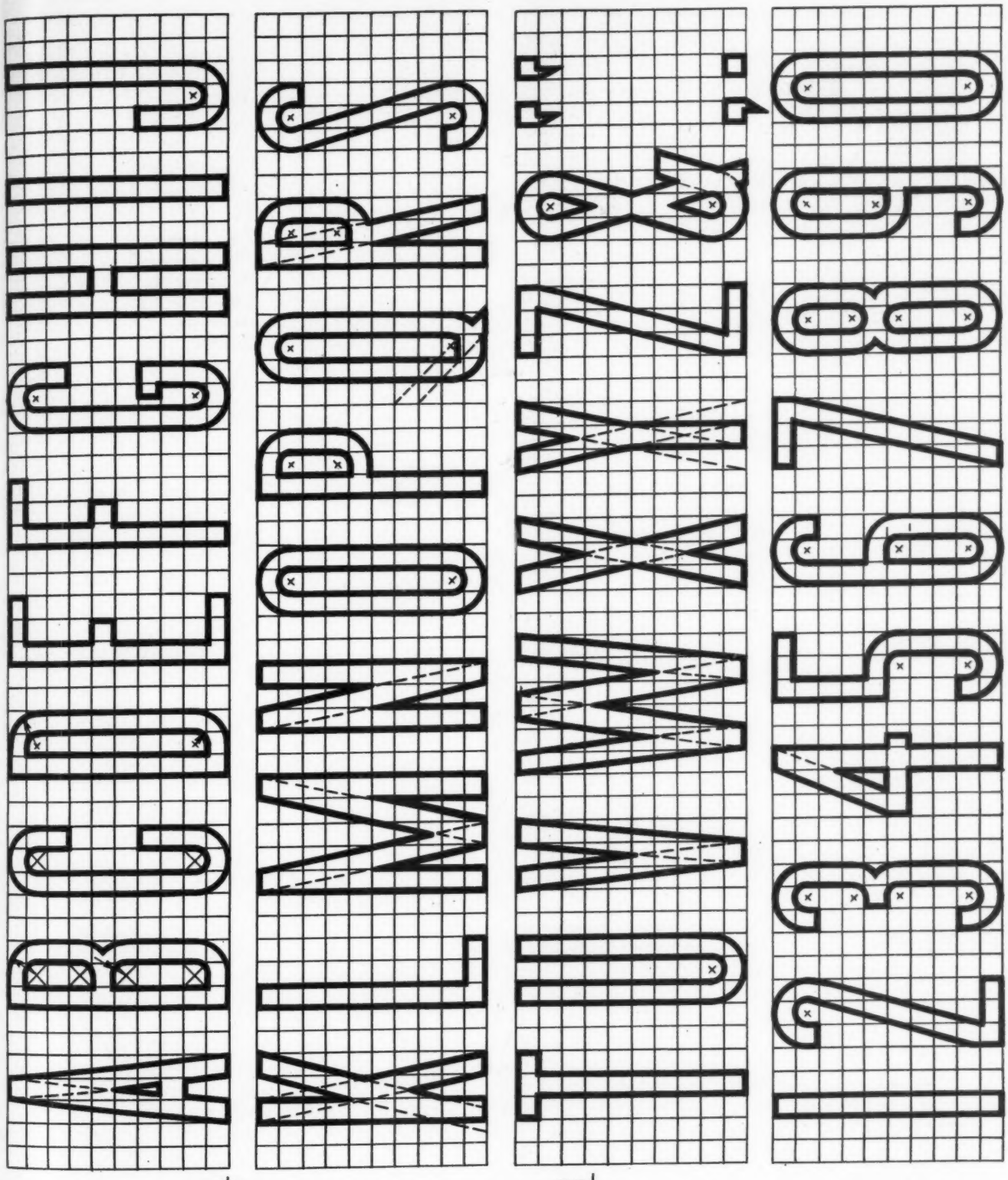
Matching — Definitions

Specific Directions: In the left-hand column you will find a list of words or terms. In the right-hand column you will find the definitions of these words or terms. Make the proper connections by lettering neatly the number preceding the definition in front of the word or term with which it should be associated.

Do you occasionally pause to summarize and repeat what you read? Answer .....

... T square	1. The expression of thought.
... Boxwood scale	2. One who draws sketches, plans, or designs; one employed in making mechanical drawings, as of machines, structures, etc.
... Scale	3. In general, a devise used as a guide for drawing vertical and inclined lines.
... Neatness	
... French curve	4. A drawing, as of machinery or structures, done with the aid of rulers, scales, compasses, etc.
... Arc	5. A drawing tool used primarily as a guide to draw horizonal lines.
... Dividers	6. A soft rubber eraser used for cleaning purposes.

(Continued on page 247)


SAMPLE SHEET
STUDY THIS SAMPLE OF GOOD LETTERING & SPACING. NOTE THAT THE SPACES BETWEEN LETTERS HAVE BEEN MADE UNEVEN TO ATTAIN THIS EFFECT.

Alphabet of condensed block letters. Submitted by Oliver Schade, A. Lincoln Junior High School, Rockford, Ill.

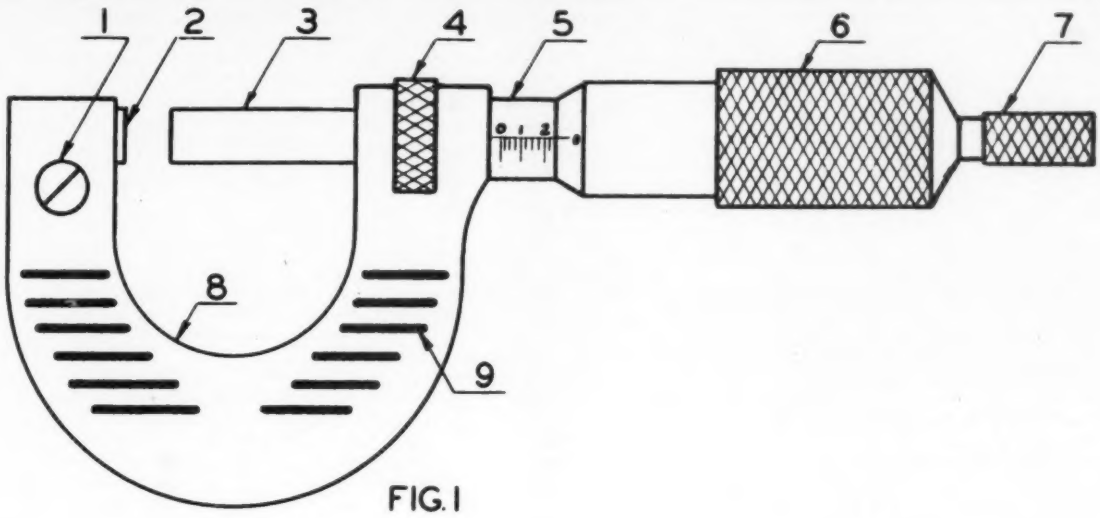


FIG. 1

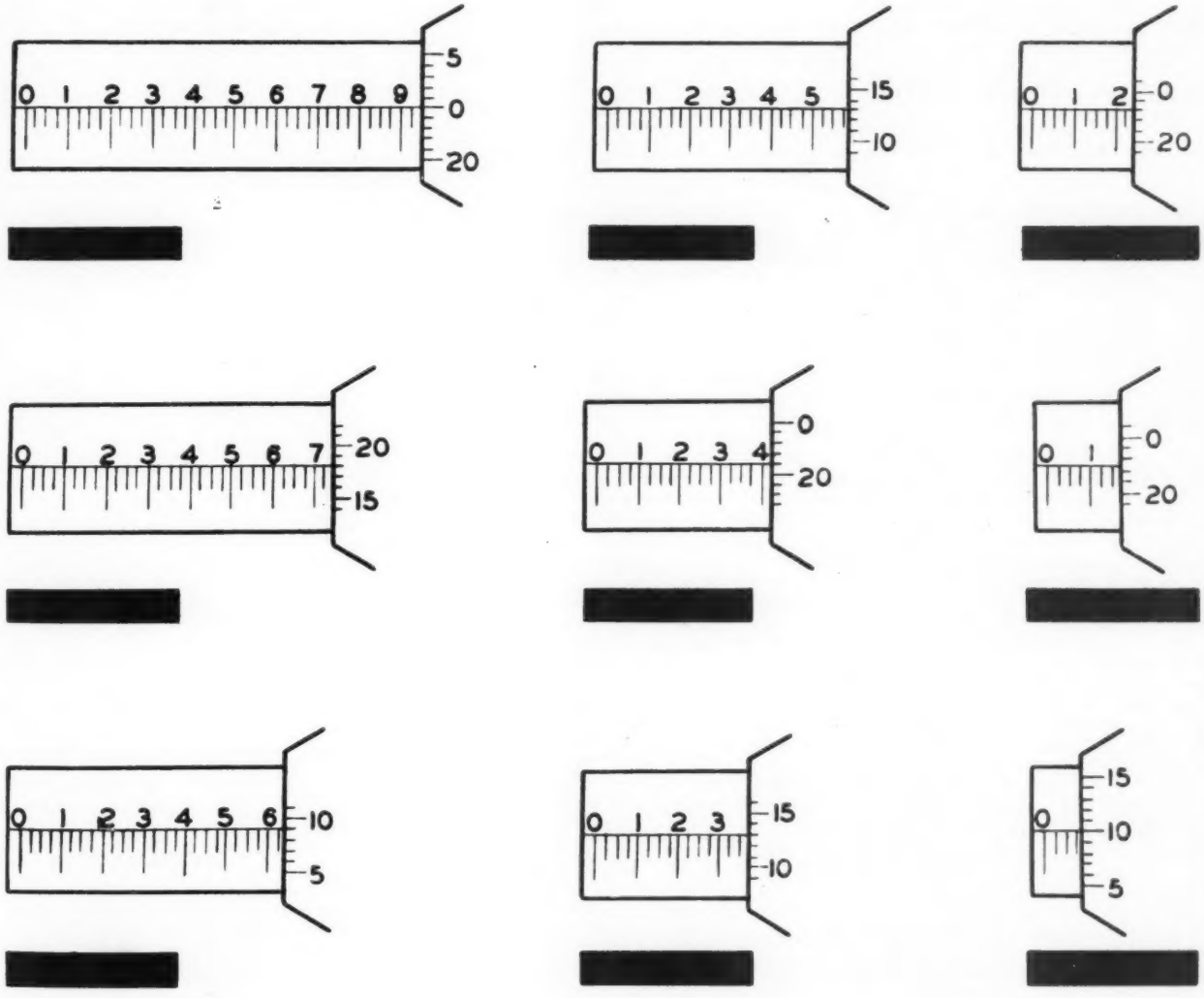


FIG. 2

Fig. 2. Micrometer Test. See Understanding Decimal Dimensions by M. F. Foss, Oxford, Ohio, on page 251

(Continued from page 242)

... Point
... India ink
... Language
... Tangent
... Compass
... Mechanical Drawing
... Grit eraser
... Draftsman
... Bow instruments
... Major axis
... Triangle
... Ruling pen
... Art gum

7. An irregular curve.
8. A measure for laying off distances.
9. A measurement used for transferring distances and for dividing lines.
10. A term given to a drawing instrument consisting of two legs joined at the top and used for drawing circles.
11. A term given to the mechanical-drawing instruments which are used for drawing small circles and making small divisions.
12. A black waterproof drawing ink.
13. A term given to a drawing instrument which is usually used for inking straight lines after the pencil drawing is finished.
14. An ink eraser.
15. Any part of the circumference of a circle.
16. Everything which adds to or detracts from the general appearance of a mechanical drawing, such as erasures, blots, even or uneven lines, poorly or well-shaped letters misspelled or correct words, etc.
17. A triangular ruler.
18. A line unlimited in length which touches a circle or other conic in only one point.
19. The longest line drawn through the center of an ellipse.
20. A position in space.

Key

1. Language. 2. Draftsman. 3. Triangle. 4. Mechanical Drawing. 5. T square. 6. Art gum. 7. French curve. 8. Scale. 9. Dividers. 10. Compass. 11. Bow instruments. 12. India ink. 13. Ruling pen. 14. Grit eraser. 15. Arc. 16. Neatness. 17. Boxwood scale. 18. Tangent. 19. Major axis. 20. Point.

Sources

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MECHANICAL-DRAWING TEST

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Completion Test

Directions: Read each sentence carefully, then fill in the blank space or spaces with a word or words which will correctly complete each sentence. Note the completed sample with the correct word (softer) written in the blank space.

Sample: The lead in a 2H pencil is softer than that in a 4H pencil. .....

1. An adaptation of freehand Gothic lettering known as the ..... style of lettering is used in notes on mechanical drawings.

2. The two kinds of Reinhardt letters used are ..... and ..... case.

3. Notes on machine drawings are generally given in ..... case or ..... letters.

4. The two parts of a T square are the ..... and the .....

5. The triangles commonly used by draftsmen are the ..... and the .....

6. Draftsmen make use of two different shaped lead-pencil points, the ..... and ..... shape.

7. The machine draftsman makes the most use of the ..... scale.

8. Mechanical drawings are usually made to scale ..... size whenever possible.

9. When a machine part is large, the drawing is usually made to scale ..... than full size.

10. When a machine part is very small and difficult to draw and dimension to scale full size, it is drawn to scale ..... than full size.

11. When a large machine part over 72 in. in length is drawn and dimensioned, the dimensions are usually given in ..... and .....

12. The ability to make a correct mechanical drawing depends on a thorough knowledge of the principles of .....

13. The three views most frequently used to describe the shape of an object are the ....., ..., and ..... views.

14. The architects' scale is used by the architect to lay out dimensions usually expressed in ..... and .....

15. The degree of hardness of lead in drawing pencils is determined by the ..... of the ..... given on the pencil.

16. The machine draftsman uses the architects' scale but frequently assumes the 1-ft. divisions on the scale to be ..... and uses the end division on the scale to obtain ..... parts of an inch.

17. A scale on which the inches are divided into tenths is called an ..... scale and is used mostly by civil engineers.

18. The metric system of measurements as used in European countries involves measuring with a scale on which the divisions are given in ..... and .....

19. In the case of an object having a slanting surface which does not show in true projection with views ordinarily used (top, front, and side), another kind of view is generally used to describe the true shape of the slanting surface which is known as an ..... view.

20. Visible edges of an object are shown with ..... lines and hidden edges are represented with ..... lines on each view.

21. The two classes of dimensions given on a drawing are ..... and ..... dimensions.

22. When the circular layout of a hole through an object is shown visible on one view, the other views will show the hole with straight ..... lines.

23. In dimensioning circular holes and projections on a machine part, it is customary to give the ..... instead of the .....

24. In case six holes of ½ in. diameter are drilled through a machine part, the customary form of note given on the drawing is as follows: .....

25. Where three, ⅜-in. tapped holes are threaded or tapped with 16 national-coarse threads, ¾ in. deep, with a class 2 fit in a machine part, the customary form of note given to express this operation is as follows: ....

26. It is customary to dimension a casting from ..... surfaces and from main .....

27. It is the usual practice to locate or dimension holes from ..... when no finished surfaces are available.

28. When it is necessary to finish only one surface of a casting, finish is marked on the edgewise view of the surface with an ..... in all views where the edgewise view of that surface appears.

29. When it is desired to finish all surfaces of a casting, finish is given in the form of a note .... or its abbreviation .... in a central position under the views.

30. Finish to the patternmaker means ..... of more stock on the surfaces to be finished so that there will be sufficient stock left on the casting obtained from the pattern to allow the piece to be machined to the finished dimensions specified on the drawing.

31. As a general rule it is well to place dimensions ..... views as far as possible, and place leader lines and notes ..... the views.

32. It is a good practice to give location and size dimensions ..... to the hole or groove on the view where it is laid out with visible lines rather than to the dotted line view of the hole or groove.

33. It is a good practice to keep ..... spacing between rows of dimensions and keep them in line with each other on ..... views.

34. Horizontal dimensions are read from ..... to ..... from the ..... of the drawing.

35. Vertical dimensions are read from ..... to ..... from the ..... of the drawing.

36. Inclined dimensions are placed as nearly right side up as possible so that they can be easily read from the lower ..... corner of the drawing.

37. The sharp corners on a pattern are usually ..... and ..... to enable drawing the pattern out of the molding sand and improve the appearance and strength of the casting obtained.

38. In a series of parallel rows of dimensions, it is a good practice ..... adjacent dimensions.

39. It is not a good practice to ..... the same dimensions on different views as it increases the chance for error.

40. In production work, the amount of variation allowed in the size of a part or the difference in thousandths of an inch between high and low limit dimensions is called the .....

41. In the fitting of mating parts, the intentional difference in their dimensions given in thousandths of an inch is called the .....

42. In makng a full-section view, one ..... of the object is cut away or removed to obtain such a view.

43. In making a half-section view, one ..... of the object is cut away or removed to obtain such a view.

44. When cross-section views are shown of the spokes or rims of flywheels and hand wheels directly on the spoke of the rim, such views are called ..... sections.

45. When a cutting-plane line is used to show where a section view is cut or taken, and the sectional view of a spoke or rim is drawn out to one side on the drawing instead of on any of the views, such a section view is called a ..... section.

46. When it is desired to show a sectional view through holes or grooves not located on the main center line of the object and the cutting-plane line changes direction frequently in order to cut across these holes or grooves,

the resulting section obtained is called an ..... section.

47. It is not customary to show ..... lines behind sectional views.

48. Crosshatching or section lining is usually drawn at a ..... degree angle and may be inclined either to the right or left as desired.

49. Crosshatch lines are spaced ....., approximately 1/16 in. apart, and ..... in the same direction on any one part.

50. The two classes of working drawings are ..... and ..... drawings.

51. A drawing that shows two or three views of an object or one part completely dimensioned for use by a workman in making the part is called a ..... drawing.

52. A drawing that shows how the parts of a project or machine are fitted together or the relationship of one part to another, showing clearly its construction, is called an ..... drawing.

53. When a sectional view is shown on an assembly drawing, the direction of crosshatching lines is ..... on adjacent parts.

54. On a sectional view of an assembly drawing it is desirable to show the various parts crosshatched according to the ..... of which each part is made and in accordance with American standard symbols.

55. Since only main center-line dimensions or practically no dimensions are given on assembly drawings, it is important to measure ..... according to the ..... of the drawing.

56. A complete list of the parts of a project or machine, giving part numbers, names, material, number required, along with necessary screws, bolts, pins, or keys used for assembly of the project is called a ....

57. For all general purpose work in machine construction, American national ..... thread is used on fasteners and machine parts.

58. On automotive and airplane parts where vibration is a factor to be considered, American national ..... thread is used.

59. The square and acme threads are larger threads which are used on lifting screws, etc., where greater ..... is desired than can be obtained by the use of American national-coarse thread.

60. In semiconventional representation of threads, the single cut thread is drawn with a half-pitch space ..... of crest and root lines.

61. In some industrial plants and schools, semiconventional representation of threads is shown by drawing crest and root lines ....., it being assumed that such representation is right-hand thread and if left-hand thread is desired it is specified by note.

62. In laying out square thread, it is necessary to multiply the number of threads per inch by ..... to determine the number of spaces to lay out per inch.

63. The inside diameter of an ⅛-in. pipe is ..... than the nominal diameter.

64. When two castings having drilled holes through each end are to be fastened together ..... are usually used.

65. When two machine parts are to be fastened together, one having a drilled hole through it and the other a threaded hole through it, a ..... screw is used, the screw sliding through the drilled hole and threading into the tapped hole.

66. When it is desired to fasten a small pulley or collar to a shaft, a ..... screw is used in a threaded hole through the collar so that the end of the screw grips or presses into the shaft.

67. When it is desired to secure a more permanent assembly of a pulley on a shaft, usually a ..... is used to lock the parts together.

68. A simple way of fastening a small collar to a shaft is to drill a hole though both parts and lock them together with a .....

69. Webs are used on a casting to give greater ..... and at the same time decrease the ..... of the casting.

70. Spur gears are used to transmit motion between shafts whose axes are .....

71. Bevel gears are used to transmit motion between shafts whose axes are .....

72. Worm gears (worm and worm wheel) are used to connect shafts which are at right angles to each other but do not .....

73. The speed ratio of two spur gears depends directly on the .... selected.

74. The number of teeth in a spur gear can be easily determined when the .... and the .... are given.

75. When time is a factor, simple machine parts are often made from .... without making mechanical drawings.

76. Freehand sketching is used extensively by draftsmen and mechanics to transmit ..... of mechanical construction quickly and clearly.

77. There are in general two types of modern electric blueprinting machines in use, namely, the ..... and the .....

78. Two types of artificial lights commonly used in electric blueprinting machines are the .... light and the .... light.

79. A blueprint is made by placing the ink tracing on the sensitive side of the blueprint paper with the ink lines of the tracing ..... and ..... the light in the blueprinting machine to allow for exposure. After sufficient exposure, the blueprint is washed in ....., than in a ..... solution, and finally in ..... again.

80. A positive print made on blueprint paper, the reverse of the ordinary blueprint, with blue lines on a white background is obtained by exposing a .... negative on the blueprint paper to light and then washing this print in the same manner as the ordinary blueprint.

81. A Van Dyke negative is made by placing the ink tracing on .... paper, with the ink lines ..... against the sensitive side of the paper, exposing to light, washing in water, then in a fixing salt and again in water. When dry the negative is treated with a ..... solution on the back side and then allowed to dry before using for making prints.

82. An Ozalid print is made by placing the ink tracing on the sensitive side of the Ozalid paper wth the ink lines ....., then exposing to light in the printing machine. The Ozalid print is next run through the Ozalid developer where ..... fumes react with the print paper thus obtaining a print with a white background and dark blue, black, or reddish brown lines according to the kind of Ozalid paper used.

83. The advantage of Ozalid prints as compared to blueprints is that they are made by a ..... process and hence are more accurate as there is no ..... as in the case of blueprints.

84. In making an ink tracing, line contrast is obtained by making sharp black object lines of ..... weight, hidden edge lines about ..... the weight of the object lines, and center lines, extension and dimension lines slightly ..... in weight than the hidden edge lines.

85. Ink lines of different weights can be made by adjusting the ..... of the ruling pen in or out by means of the small adjusting screw.

86. Ink lettering of notes on machine drawings is usually done ..... and with a ..... pen.

87. It is important to ..... the inking instruments carefully after using them as ink that dries on the steel causes ..... and when fresh ink is put in the instrument again, it builds on the ink already there and does not flow freely in using the pen.

88. A fairly strong solution of ..... is exceptionally good for cleaning ink from inking instruments.

89. Perspective drawing is a form of pictorial drawing used mostly by ..... draftsmen.

90. Isometric drawing, a form of pictorial drawing, is extensively used for ..... purposes in mechanical-drawing textbooks and technical magazines.

91. Cabinet drawing is used to illustrate ..... designs in circulars and sales catalogs.

92. Development drawing is used mostly by ..... draftsmen and workers in the layout of pipes, ventilators, auto-body design, etc.

93. The laying out of flat patterns from which curved surfaces can be formed without stretching the material is known as ..... drawing.

94. The development of a cylinder is rectangular in shape and the width of this rectangle is equal to the ..... of the cylinder and its length is equal to the ..... of the cylinder.

95. The size of the rectangular development for a cylinder 2½ in. in diameter and 3 in. long would be ..... by ..... inches.

96. The development of a right circular cone rolls out in the shape of a ..... of a circle, whose center angle a can be computed by use of the formula $a = \frac{r \times 360°}{R}$, where r = radius of the circular base of the cone and R = the slant height of the cone.

97. The center angle a for a conical development of a right circular cone having a base 2 in. in diameter and a slant height of 7 in. would be ..... degrees.

98. The development layout of a cone is made up of a series of small ..... surfaces determined by stepping off chord lengths approximately equal to the small circular arcs into which the circumference of the base is divided and the use of .... of the elements laid out on the surface of the cone.

99. The true length of any element on the surface of a cone is found by looking ..... to the incline of the element and method of layout involves using the apex of the cone as a center and revolving the element ..... to one of the co-ordinate planes of projection where its projection will show in true length on that plane.

100. When two circular pipes intersect at an angle, a series of perpendicular planes passed through both pipes parallel to their axes will cut off elements on the surface of both pipes which meet in points common to both, and the joining of these points gives the .... between the two pipes.

KEY

The words are given in the order in which they are used in filling in the blanks in each statement.

1. Reinhardt
2. Upper, lower
3. Upper, capital
4. Blade, head
5. 30–60, 45
6. Cone, wedge
7. Architect's
8. Full
9. Less
10. Larger
11. Feet, inches
12. Projection
13. Front, top, side, or end
14. Feet, inches
15. Number, H mark
16. Inches, fractional
17. Engineer's
18. Centimeters, millimeters
19. Auxiliary
20. Solid, broken, or dotted
21. Size, location, or position
22. Invisible or dotted
23. Diameter, radius
24. ½ drill — 6 holes
25. ⅜–16 NC — 2 ¾ deep — 3 holes
26. Finished, center lines
27. Main center lines
28. "f"
29. Finish all over or F.A.O.
30. Allowance or addition
31. Between, outside
32. Adjacent or near
33. Uniform, adjacent
34. Left, right, bottom
35. Bottom, top, right side
36. Right-hand
37. Rounded, filleted
38. Stagger
39. Repeat
40. Tolerance
41. Allowance
42. Half
43. Quarter
44. Revolved
45. Removed or remote
46. Offset
47. Dotted or invisible
48. 45
49. Uniformly, slant
50. Detail, assembly
51. Detail
52. Assembly
53. Reversed
54. Material
55. Accurately, scale
56. Bill of parts
57. Coarse
58. Fine
59. Strength
60. Slant
61. Vertically or horizontally
62. 2
63. Larger
64. Bolts
65. Cap or machine
66. Set
67. Key
68. Pin
69. Strength, weight
70. Parallel
71. Intersect or meet
72. Meet or intersect
73. Pitch diameters
74. Pitch diameters, diametral pitch
75. Freehand sketches
76. Ideas
77. Horizontal, vertical
78. Carbon arc, mercury-vapor vacuum tube
79. Up, toward, water, fixing, water
80. Van Dyke
81. Van Dyke, down, transparentizing
82. Up, ammonia
83. Dry, shrinkage
84. Medium, half, less
85. Nibs
86. Freehand, ball point
87. Clean, corrosion
88. Ammonia
89. Architectural
90. Illustrative
91. Furniture
92. Sheet-metal
93. Development
94. Length, circumference
95. 3, 7.854
96. Sector
97. 51.4
98. Triangular, true lengths
99. Perpendicular parallel
100. Curve of intersection

TEST IN ACCURACY, USING VARIOUS SCALES

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This test will enable the teacher to see whether his students really know how to use the various scales, as the scales on the architect's scale should be used.

The problem for the test can be placed inside a 7 by 10-in. working space. All points should be accurately located and the lines accurately drawn.

A. Draw a horizontal line 2 in. above the lower border line.

B. Upon this line, 1½ in. in from the left-hand border line, locate point number 1.

C. From point 1 draw a vertical line upward, 6 in. long and locate point number 2, using a half-size scale.

D. From point 2 measure to the right horizontally 6¼ in., using a scale of 3 in. equals 1 ft. This locates point number 3.

E. With point 3 as a center and a radius of 2 ft. 1½ in., to the scale of 1½ in. equals 1 ft., swing an arc cutting the bottom horizontal line at points 4 and 5. From point 3 draw lines to each of these points. On line 3–4 measure down and to the left a distance of 1 ft. 7 in. to a scale of 1 in. equals 1 ft. This locates point number 6. Draw a horizontal line from point 6 until it touches line 3–5 at point 7.

F. From point 5 measure horizontally to the right using a scale of ¾ in. equals 1 ft., a distance of 2 ft. which locates point number 8.

G. From point 8 and with a radius of 6 ft. 4 in. to the scale of ½ in. equals 1 ft., swing arcs cutting the extension of the horizontal line 2–3, thus locating points 9–10. From points 9–10 draw lines to point 8.

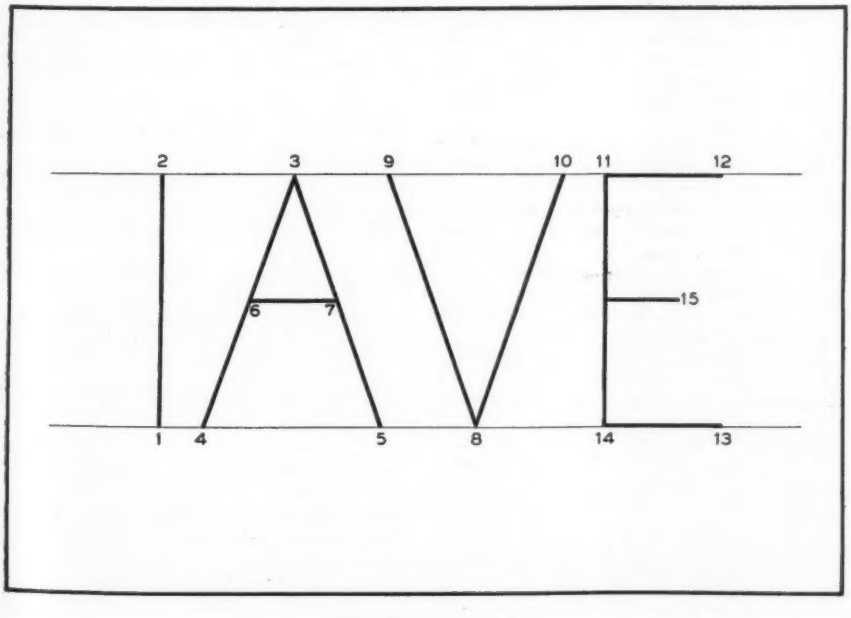
H. From point 10 measure horizontally to the right 1 ft. 4 in. to a scale of ⅜ in. equals 1 ft., locating point number 11. From point 11 draw a line horizontally to the right a distance of 7 ft. 5 in. using a scale of 3/16 in. equals 1 ft., locating point number 12.

I. From point 12 measure down vertically a distance of 3 in. and locate point number 13.

J. From point 13 measure horizontally to the left 5 ft. 6 in. using a scale of ¼ in. equals 1 ft. and locate point number 14.

K. Connect point 11 and 14 and at the mid-point of this line draw a line horizontally and to the right 7 ft. long, using a scale of ⅛ in. equals 1 ft. This locates point number 15, and the stopping point.

L. If your work has been done accurately, you will have layed out the initials of the name of the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazine.



The accuracy test

WOODWORKING TEST — MULTIPLE-CHOICE QUESTIONS

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Questions Based on Hjorth's *Principles of Woodworking*

The correct, or nearly correct, answer is to be indicated in the space to the left of each question by placing an (A), (B), or (C) in the space provided.

..... 1. Doweled joints are gauge marked from: (A) four sides, (B) one face, (C) one face and one edge.

..... 2. Dowels are made from: (A) birch or maple, (B) pine, (C) basswood.

..... 3. If a mortise-and-tenon joint is not used in a face frame, the next best joint to use is: (A) end-lap joint, (B) dado, (C) dovetail-lap joint and cross-lap joint.

..... 4. The most accurate way of marking a tenon shoulder is by use of: (A) 6-H pencil, (B) sharp knife, (C) awl.

..... 5. The term "haunched" refers to: (A) slip joint, (B) dovetail joint, (C) tenon.

..... 6. The strongest dovetail joint is made with: (A) tails and pins equal, (B) pins larger, (C) tails larger.

..... 7. The correct angle with the base for dovetail construction is: (A) 30

deg., (B) 60 deg., (C) 75 to 80 deg.

..... 8. The best construction for a drawer front is: (A) rabbet, (B) half-lap dovetail joint, (C) through dovetail joint.

..... 9. The best type of joint for a panel frame is: (A) slip joint, (B) haunched mortise-and-tenon joint, (C) end-lap joint.

..... 10. A rule joint is used on: (A) table tops, (B) drawer fronts, (C) drop-leaf table tops.

..... 11. The most satisfactory glue for woodworking is: (A) vegetable glue, (B) casein glue, (C) animal glue.

..... 12. Animal glue is prepared before heating by: (A) soaking in hot water for one hour, (B) cover with water and let set overnight.

..... 13. Thick glue results in: (A) a good job, (B) prevents proper contact.

..... 14. Work to be glued up is protected from the clamps by: (A) light clamp pressure, (B) blocks of wood.

..... 15. Hot glue is prevented from chilling in cold weather. (A) by heating the pieces to be glued, (B) by raising the temperature of the glue to over 200 deg.

..... 16. Surplus glue is best removed by: (A) a chip of wood, (B) a dull chisel, (C) a piece of paper.

..... 17. A panel in a frame is set loose: (A) so as to be removable, (B) to allow for expansion and contraction.

..... 18. A frame is tested for flatness and *wind* by: (A) placing a steel square across the rails at the joints, (B) with a plumb level.

..... 19. Cabinets having two opposite sides alike are: (A) all joints glued at one time, (B) each end glued separately before final assembly.

..... 20. When driving joints together with a mallet, the work is protected with: (A) a smooth block of wood placed over the joint, (B) by padding the face of the mallet.

..... 21. Where blocks are placed at joints for protection when gluing up: (A) surplus glue is removed before applying clamps, (B) a piece of paper is placed between the block and the glue smeared surface.

..... 22. Mitered picture and frame joints are glued up with: (A) bar clamps, (B) by driving double wedges between prepared cleats fastened on a board.

..... 23. Segments and curved pieces are clamped together with: (A) column clamps, (B) bar clamps.

..... 24. Table tops and other wide tops are: (A) glued to the side rails, (B) screwed or nailed tightly in place, (C) put on with slot brackets or screws allowing for movement from shrinkage.

..... 25. The best cabinet hinges are made of: (A) brass, (B) steel, (C) duralium.

..... 26. Desk and box locks have: (A) a plain bolt, (B) a bolt provided with a hook.

..... 27. Elbow catches are put on: (A) the right-hand door of double doors, (B) the left-hand door.

..... 28. Door bolts or flush bolts are screwed to double doors at: (A) the top or bottom of a door, (B) at the center lock rail.

..... 29. Professional wood turners use: (A) the cutting or paring method, (B) the scraping method.

..... 30. The most modern type of lathe headstock is driven by: (A) overhead countershaft and cone pulley, (B) cone pulley on motor below headstock, (C) motor head with variable speeds.

..... 31. Stock over 6 in. in diameter should be turned: (A) high speed, (B) slowest speed, (C) medium speed.

..... 32. The height of the tool rest on the lathe is placed: (A) ⅛ to ¼ in. above center, (B) at center, (C) below center ⅛ to ¼ in.

..... 33. Beading tools are used to turn beads the size of which are: (A) from ¾ to 1¼ in., (B) from ⅛ to ⅝ in.

..... 34. The edge of a disk is reduced to a diameter on the lathe with: (A) round-nose chisel, (B) skew chisel and square-nose chisel.

..... 35. A hole is cut in the face of a disk with: (A) skew chisel, (B) parting tool.

..... 36. A disk sander is used on the lathe to: (A) smooth flat and concave surfaces, (B) convex surfaces and end wood.

..... 37. Wide lines for band inlaying are gauged with: (A) slitting gauge, (B) butt gauge.

..... 38. Material for split turning is prepared by: (A) gluing material together, (B) by using wood screws at the ends and a spot of glue.

..... 39. Brown paper is glued to the top of insets to: (A) protect the surface, (B) to hold the various parts together.

..... 40. A reeded surface is produced by: (A) two V cuts to form a convex rounded surface, (B) a gouge cut to form a concave depression.

..... 41. The spacing of reeds and flutes on a turned column can be laid out with: (A) a pair of dividers, (B) a piece of paper the length of the circumference divided into equal parts.

..... 42. It is easier for the beginner to carve a piece from: (A) a drawing or detail of the work, (B) from an actual carving used as a model.

..... 43. The beginner on wood carving needs: (A) six or eight selected tools, (B) 25 or 30 selected tools.

..... 44. The bands in strapwork carving are more commonly carved in: (A) relief, (B) incised.

..... 45. Mitered moldings open up at the joints because: (A) they are not cut to fit, (B) because of shrinkage across the grain.

..... 46. A better joint that will not open up can be made by: (A) mitering, (B) coping.

..... 47. Veneer is applied to both sides of a board or core to: (A) make it stronger, (B) to prevent warping by equalizing the pull on each side.

..... 48. A caul is: (A) a wood pressure cover used when clamping veneer in a press, (B) a sheet of metal (zinc) used to hold the heat in veneering.

..... 49. Overlays are: (A) thin pieces of wood let into the surface of veneers, (B) applied on top of veneers to form a raised part.

..... 50. Two toning with veining is produced by: (A) setting in a lighter colored wood, (B) staining one part a lighter color.

Key

1. (B) 2. (A) 3. (C) 4. (B) 5. (C) 6. (A)
7. (C) 8. (B) 9. (B) 10. (C) 11. (C) 12. (B)
13. (B) 14. (B) 15. (A) 16. (B) 17. (B) 18. (A)
19. (B) 20. (A) 21. (B) 22. (B) 23. (A) 24. (C)
25. (A) 26. (B) 27. (B) 28. (A) 29. (A) 30. (C)
31. (B) 32. (A) 33. (B) 34. (B) 35. (A) 36. (B)
37. (A) 38. (B) 39. (B) 40. (A) 41. (B) 42. (B)
43. (A) 44. (A) 45. (B) 46. (B) 47. (B) 48. (A)
49. (B) 50. (B)

WE WHO TEACH

Adam N. Reiter

We never know the measure of our counsel;
The joy that kindly words and deeds bestow:
Or depth of searing thrusts — and more's the pity —
We never see the scars. . . . We never know.

We seldom think in terms of fear and terror,
That haunt a childish mind in fancied trial:
For what to us is but a merry jaunting,
To him, may loom a weary, rugged mile.

We rarely note the gratitude, unbounded:
Of one, who groping, stumbling by the way,
Finds heart again; when on the dreaded morrow
It dawns for him — a beautiful today.

The mind of youth is as a sturdy seedling,
Transplanted to a garden, crudely made;
Wherein, by faithful care of faulty tending,
Of such as we, may flourish or may fade.

Our task must not admit of empty prating,
Nor conscious lack, when sowing what we will:
For he who tries his hand, to find it wanting,
Makes evident the lie that bears him ill.

We never know, when one of rare attainment;
Who, having supped and fed in full degree
May turn and say (and this be our rewarding),
"As you have taught, so shall I strive to be."

We never know, when mem'ries of our toiling
Will flare anew; to cast a radiant glow —
For having set some childish heart a-singing,
Or wreathed a face in smiles. . . . *We never know.*

Problems and Projects

UNDERSTANDING DECIMAL DIMENSIONS

M. F. Foss,
Oxford, Ohio

(For Micrometer Test, Figure 2, see page 245)

One keynote of modern industry is interchangeable manufacture. In order to understand interchangeable manufacture, such terms as decimal dimensions, limits, fits, tolerances, and allowances must be made clear. Textbooks in engineering drawing or standard handbooks will provide a discussion of these terms. Unless this reading knowledge is supplemented with some kind of individual experience gained through visual instruction these terms will lack meaning. The following work kit and instruction unit is suggested as one approach to this problem.

The work kit includes tools and test bars. The tools consist of a 0–1 in. micrometer, one 6-in. inside caliper and one 6-in. outside caliper, a 6-in. machinists' scale graduated to 64ths. The test bars can be made in the high school machine shop. The first test bar is shown in Figure 3. The object is to show that accuracy required for interchangeable manufacture is possible only with decimal dimensions and precision instruments. The second test bar is shown in Figure 4. The flats need not be milled with absolute accuracy since the object of this bar is to show that there are limitations of the machinists' scale compared with the micrometer. The holes provide experience in the use of the inside calipers.

Fig. 1. Learning to use various measuring devices

One work kit will serve an entire class. There should be enough instruction units for each student. The instruction unit is divided into three parts. Part I lists standard reference material, presents a micrometer chart and provides reading drill. Part II provides tables for the test bar readings. Part III relates theory in terms of class experience.

This teaching unit has been used in the high school drafting room with gratifying results. Students learn not only the use of micrometers, but gain an appreciation of modern machine-shop measuring devices. Decimal dimensions, limits, fits, and tolerances become meaningful terms.

The student receives the following instruction unit.

Part I. Reference Material and Reading Drill

Read the following references and list parts of the micrometer in the spaces provided.

Machine Tool Operation, Burghardt, pp. 74–81.

Small Tools Catalog, No. 31. Brown and Sharpe, pp. 2–6.

1.	6. .....
2.	7. .....
3.	8. .....
4.	9. .....
5.	

Complete the following statements on the use of the micrometer:

The micrometer should be held by the ....., part number ..... The work to be measured is placed between the ....., part number ...., and the spindle, part number ..... An experienced mechanic can adjust the spindle by the ....., part number ...., and secure uniform pressure. A beginner should *always* adjust the spindle by the ....., part number ..... This will secure uniform pressure at all times and avoid damaging the ..... of the micrometer. The spindle may be locked in any position by the ....., part number .....

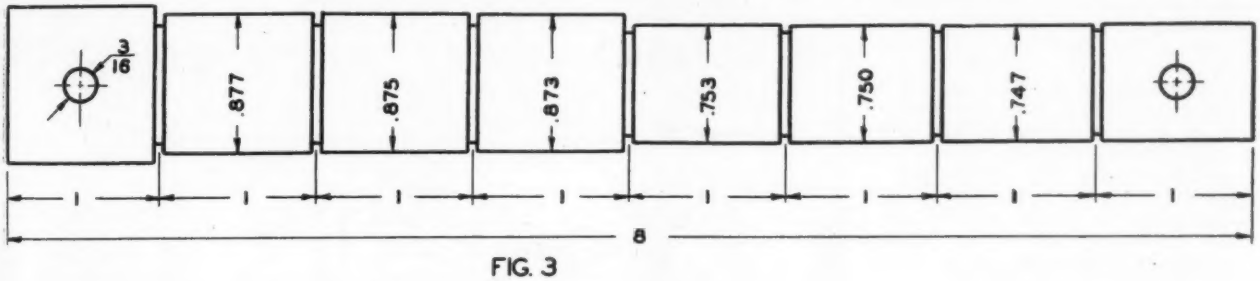


FIG. 3

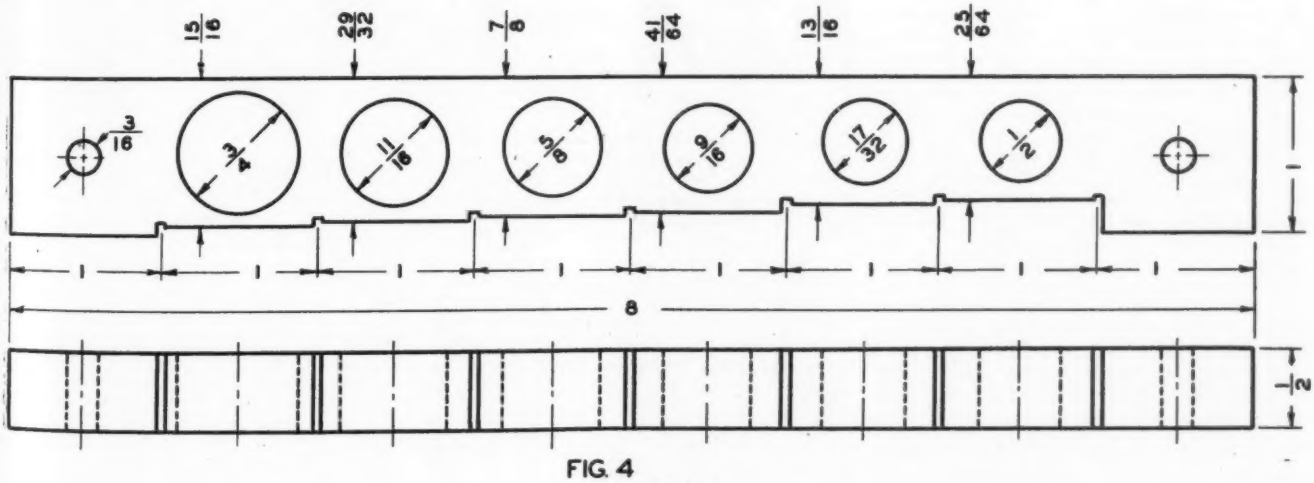


FIG. 4

Measuring bars

The decimal equivalents, part number ...., are useful in determining the nearest fractional reading. A 0–1 in. micrometer may be checked for accuracy by .....

.....

Read the following micrometer settings and place the answer in the spaces provided.

Part II. Complete the following table from the cylindrical test bar.

	Reading with calipers	*Reading with micrometer*
Plug 1		
Plug 2		
Plug 3		
Plug 4		
Plug 5		
Plug 6		

Complete the following table from the flat test bar.

	Reading with micrometer	*Reading with scale*
Bar No. 1		
Bar No. 2		
Bar No. 3		
Bar No. 4		
Bar No. 5		
Bar No. 6		

Complete the following table by measuring the holes.

	Reading with caliper	*Reading with scale*
Hole No. 1		
Hole No. 2		
Hole No. 3		
Hole No. 4		
Hole No. 5		
Hole No. 6		

Part III

What is meant by *interchangeable manufacture?* (See *American Machinists' Handbook.*) How must drawings for interchangeable manufacture be dimensioned? Why?

.....

.....

.....

.....

.....

Define the following terms:

1. Limits .....
2. Tolerance .....
3. Allowance .....

INDIAN DESIGNS AND DECORATIONS

W. Ben. Hunt,
Hales Corners, Wis.

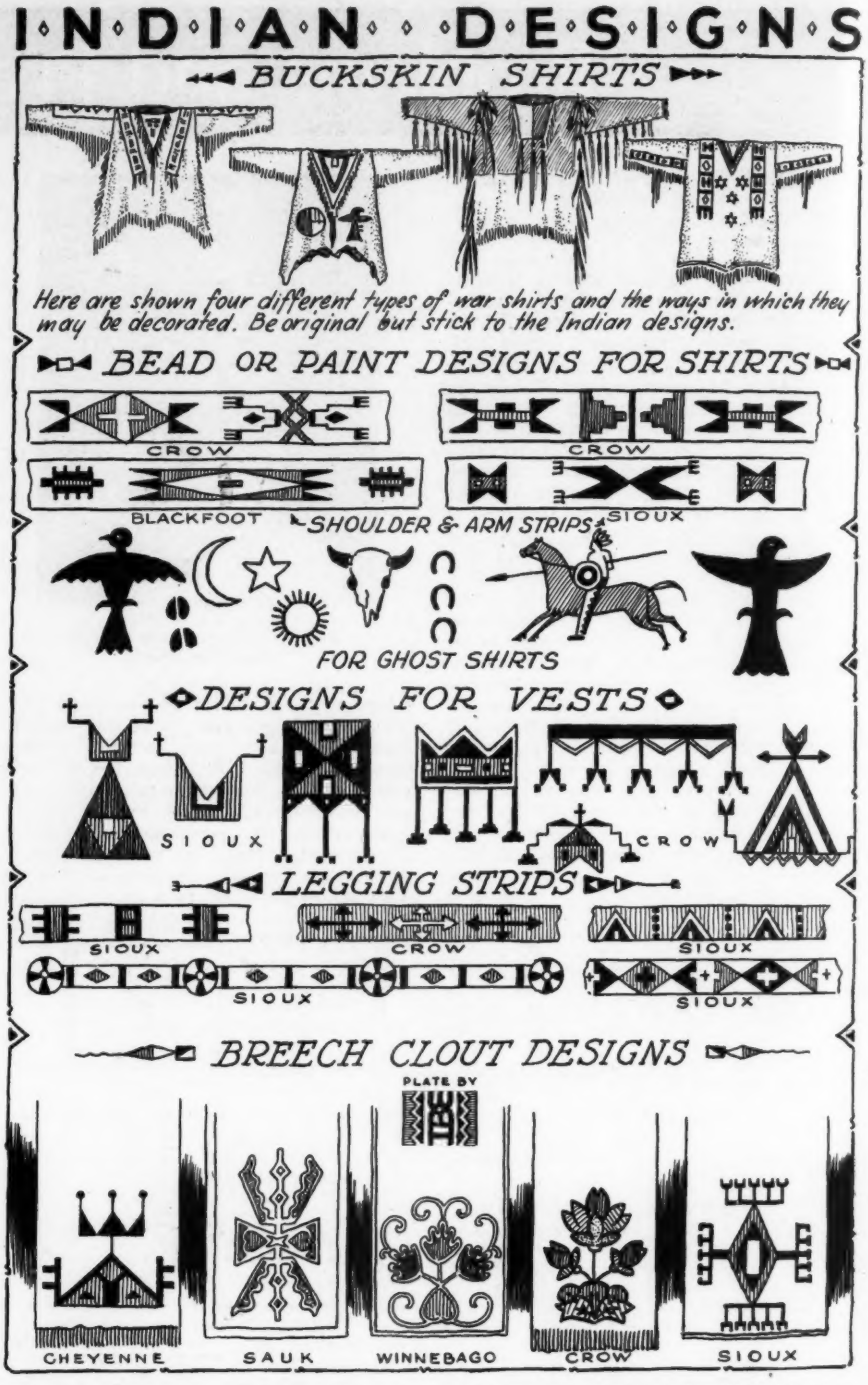
Before the white man came to this country, Indians made their clothing of furs and buckskin and decorated it with quills, beads, and paints.

The larger beads were mostly used for necklaces and belts. Dyed porcupine and feather quills were used to decorate buckskin articles. When smaller beads later became available, these were substituted for the quills, because they not only were brighter in color, but they also were easier to work. The plains Indians used paint to decorate their tepees and their clothing. When the white man's paints, beads, materials, dyes, and tools became available, the Indian quickly adopted them, but he stuck to his own designs and symbols.

The designs and decorations shown herewith have been prepared for lovers of Indian lore who may not have access to libraries and museums. Some of the designs shown are typical of certain tribes. While it is quite permissable to mix these designs to some extent, yet this should not be done too much. A Sioux outfit with a Navajo design is not proper.

Most of the designs for wearing apparel shown here were taken from those commonly used by the plains Indians. Boys who copy these designs for decorating their Indian tepee, moccasins, and other pieces of wearing apparel need not fear that their equipment will have that mail-order-house look.

The designs shown were taken from ethnological books, U. S. National Museum Reports, and other sources found at the Milwaukee Public Museum, Milwaukee, Wis.

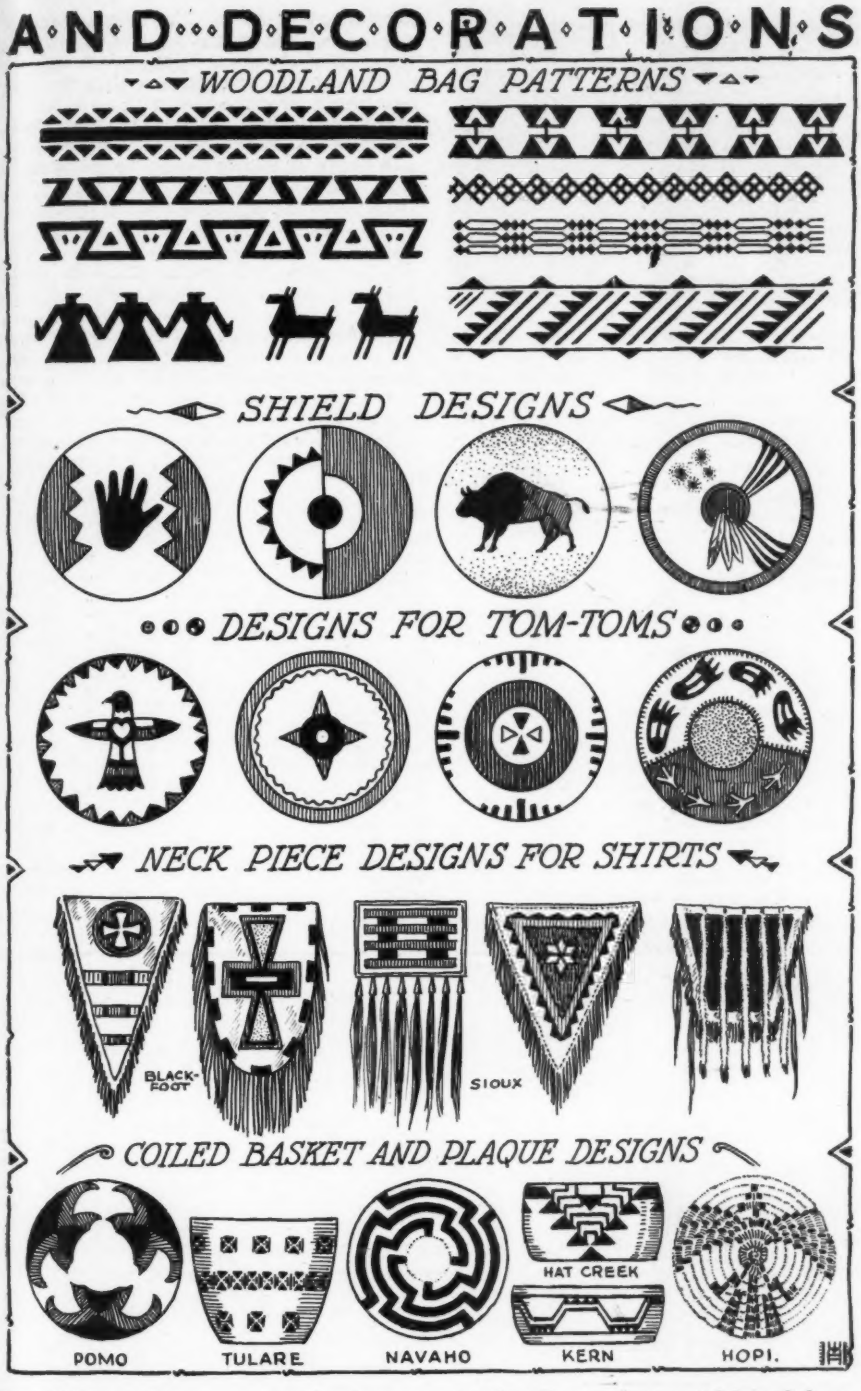


CASTING COMPOSITIONS FOR CRAFTS PROJECTS

Lowell C. Ferguson,
Stockton, Calif.

The sawdust which accumulates around the school workshop can be turned to practical use in the making of compositions for use in any of the varied projects in which ornamental castings, and the like, are required. This sawdust presents to the instructor an inexpensive medium which is sufficiently flexible in its applications as to be readily adapted to many arts and crafts projects in both the elementary and advanced grades.

The formulas given herewith have been



thoroughly tested in use and, although extremely simple and easily compounded, they are entirely practical and reliable. The mixtures can be cast in molds of celluloid, plaster of Paris, or wood. Gelatine or glue molds are not recommended for use with formula No. 2 as some heat is generated in mixing and there is a possibility of the mold softening.

Formula No 1. Four parts dry whiting, 1 part hot glue, 3 parts fine sawdust, ½ part turpentine. Knead well, mold, then dry quickly.

Formula No. 2. Five parts Portland cement, 2 parts plaster of Paris, 2 parts fine hardwood sawdust, 1 part powdered alum. Mix to a thick cream and run into molds. This mixture sets very quickly and leaves the mold easily.

Incidentally, sawdust containing pitch, or excessive foreign matter should be rigidly avoided in mixing these compositions. Use clean, sifted sawdust for best results.

MAKING MIMEOGRAPH WORK MORE ATTRACTIVE

Lowell C. Ferguson,
Stockton, Calif.

The booklets reproducing various lettering alphabets as usually furnished with mimeographing machines are seldom used to the fullest advantage because they cannot be conveniently placed beneath the stencil. To simplify matters cut the letters into strips and then glue them end to end. The resulting strips can be inserted under the stencil and moved back and forth for accurate tracing of the letters.

For shading illustrations to be reproduced, neat stippled effects may be had by laying different grades of sandpaper under the stencil and then rubbing over its surface with a blunt instrument until the desired effect is obtained. Line drawings on zinc, and similar cuts, can also be readily duplicated. In this case reverse the stencil and set the cut under it. Put a piece of fine silk cloth over the top and rub the entire surface with the blunt end of a stylus handle, or with a fountain pen.

Stencils can be preserved for future use by placing the stencil face down on a thick sheet of paper and removing the ink from the back with a sponge saturated with gasoline.

ART-METAL WORK

V. P. Conners,
Christopher Gibson School,
Boston, Mass.

(*Continued from page 18A, May, 1941, issue*)

Etching

Etching is another way of decorating metal. All metals can be etched but there are a variety of acids, and some work better on one kind of metal and others etch faster on others. The amateur or homecraftsman can derive much pleasure from etching and can soon reach the stage of the expert.

As usual the first step is the selection of a design. The design must fit the metal to be used. In the beginning the lines should be wide enough to be put on with a brush, but later one can go in for finer work.

Clean the metal thoroughly by means of one of the methods already described. From now on keep the side to be etched free of finger marks. The moisture from the fingers often causes an acid to act in a different manner.

The principle of etching is to cover the metal not to be lowered with a resist and leave the exposed metal to be eaten away by the acid bath.

The two most common resists are asphaltum varnish and beeswax, although many companies have prepared resists that are made up according to a variety of formulas.

Asphaltum varnish has been found very satisfactory by the writer although finer work can be often obtained with beeswax. If the asphaltum is too thick, add a little turpentine, and to hasten drying, add a few drops of ordinary drier. Paint in the areas that are not to be etched and let stand for 12 hours, or overnight, if possible. The resist should be applied with a fine camel-hair brush. If the article is to be completely covered with the acid, paint the edges, and in some cases the entire back.

It is best to use the smallest glass container that will hold the article. In this manner only a small amount of acid will be required. This not only is economical but it also liberates less fumes in the room.

The acid can be mixed in such proportions as: 1 part acid — 1 part water, 1 part acid — 2 parts water, 1 part acid — 3 parts water, 1 part acid — 4 parts water, 1 part acid — 5 parts water.

The mixture to be used depends on how fast the acid is to cut. Frequently old mixtures are used and the metal kept in the solution for days until the desired depth is reached. At other times the cut can be made with a strong solution in a fraction of a minute.

Acids for different metals: nitric acid is used for etching nickel silver, sterling silver, pewter, brass, and copper.

Sulphuric acid can also be used for etching brass and copper.

Aluminum has to be etched in two stages. After painting on the design with the usual resist, use one of the following dips to remove the coating of aluminum oxide which covers this metal.

1. One part stannous chloride and 100 parts of 10 per cent hydrochloric acid.

2. Ten per cent hydroflouric acid. (NOTE: this acid must be kept in a rubber bottle.)

After the oxide has been removed, rinse the piece thoroughly and place it in the second and final dip.

Equal parts hydrochloric acid and water give a quick etch. If the action is too fast, slow down by adding water. At all times keep face away from the acid and it is advisable to wear rubber gloves.

The time to keep the metal in the dip can only be told by experience. To see whether the desired cut has been obtained, remove the piece from the acid. If the cut is not deep enough, return the metal to the acid until the desired effect has been attained. With a little experience, one can get many tones in the design, by etching some parts more than others.

Remove asphaltum varnish with a soft cloth and turpentine. Then clean by using one of the methods already described.

Through experience one will become better acquainted with the metals, so that he can proceed in the right manner to obtain desireable results.

(To be continued)

A MODERNISTIC DESK

Vernon C. Watkins,

Nebraska State Teachers College, Kearney, Neb.

The desk described herein is made of solid walnut, except some of the hidden parts, and is assembled almost entirely with glue. Fastening of the drawer pulls is accomplished by both screws and glue, as are the cleats that keep the bottom drawer from dropping down when pulled out. The three ends (one inside the knee hole) and back are made of ¾-in. stock, reinforced with oak strips 2½ by ⅜ in. at both top and bottom. This tends to prevent warping and also reduces chances of splitting. The edge of the strips being against the top, affords a better glue surface than the end grain would otherwise give.

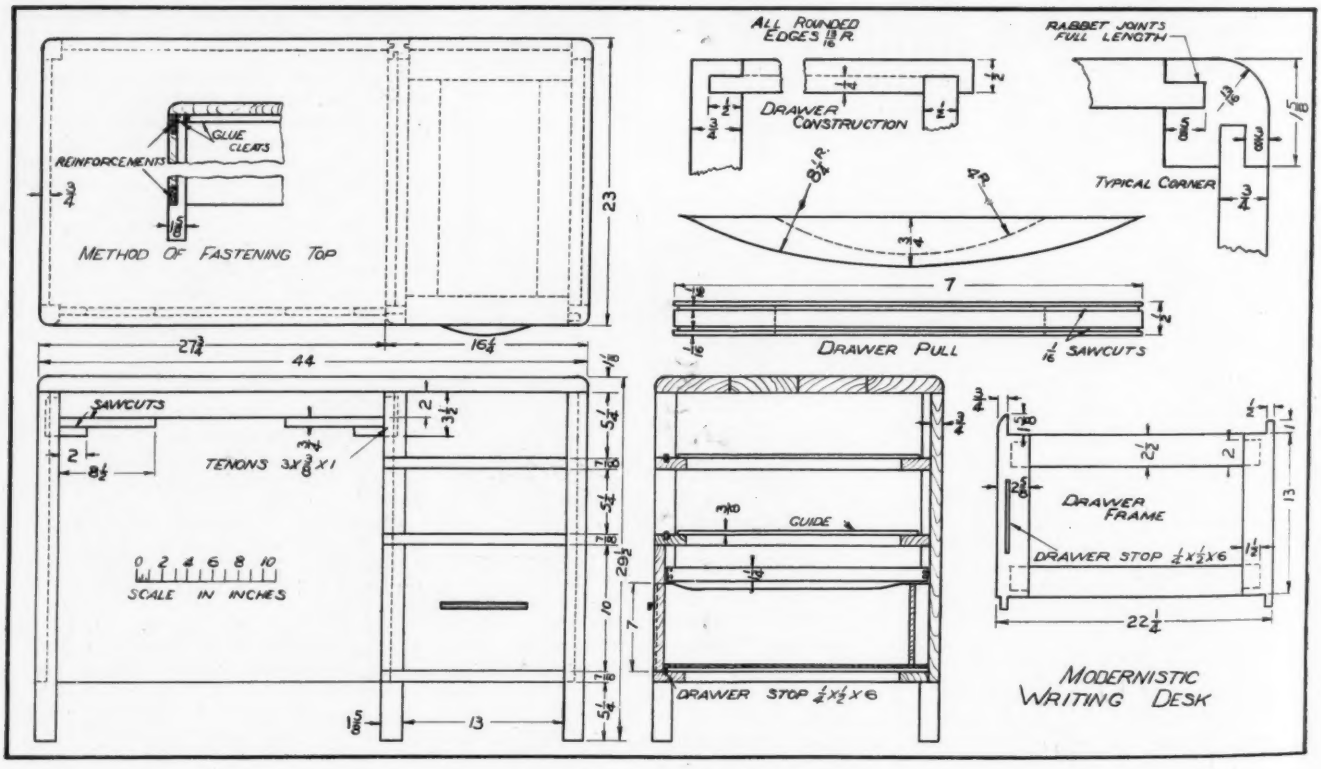
The top is held in place by glue alone. Therefore, in order to insure a lasting joint with plenty of holding power, the glue surface must be doubled by gluing cleats ¾ by ¾ in. along all of the panels, inside and just below the top. Then when the project is ready for installing the top piece, it can be leveled with a jointer plane, thus getting all of the cleats flush with the top end of the sides, back, and legs.

Finishing the desk might be done in several different ways but perhaps the most appropriate and lasting method is a rubbed varnish finish. Stain with oil stain, then fill with stained silex filler and allow at least 12 hours for drying. Sand lightly and give it a coat of

Bill of Material

No. Required	Name	Material	Size
6	Legs	Walnut	1⅝ x 1⅝ x 28
1	Top	Walnut	23 x 44 x 1⅛
3	End pieces	Walnut	21 x 23 x ¾
1	Large back piece	Walnut	26½ x 23 x ¾
1	Small back piece	Walnut	14 x 23 x ¾
1	Knee piece	Walnut	3½ x 26 x ¾
3	Drawer frame fronts	Walnut	2½ x 15½ x ⅞
2	Drawer fronts (small)	Walnut	5⅛ x 13 x ¾
1	Large drawer front	Walnut	10 x 13 x ¾
6	Drawer frame sides	Red Oak	2½ x 20 x ⅞
3	Drawer frame backs	Red Oak	2½ x 15 x ⅞
4	Drawer sides (small)	Red Oak	5⅛ x 22 x ½
2	Drawer sides (large)	Red Oak	7 x 22 x ½
2	Drawer backs (small)	Red Oak	5⅛ x 12½ x ½
1	Drawer back (large)	Red Oak	7 x 12½ x ½
6	Drawer guides	Red Oak	1¼ x 19½ x ¼
2	Drawer supports	Red Oak	1⅜ x 21 x ½
3	Drawer bottoms	Fir plywood	12½ x 22 x ¼
3	Drawer pulls	Walnut	1 x 7 x ½
7	Cleats for gluing on top	Pine	

Glue, shellac, sandpaper, varnish, screws (14, 1" by No. 7), pumice stone, wax, paraffin.



Details of a modern writing desk

50–50 shellac and alcohol to further fill and seal the pores. Allow the shellac to dry hard, at least eight hours, then go over it lightly with 6/0 sandpaper and proceed with the first coat of varnish. To insure a good level finish, give the desk at least four coats of high-grade floor varnish being sure to sand sufficiently between coats. Since variety in the proper amounts is always advantageous, fill the flutes (on the drawer pulls and knee piece) with tan enamel. This gives it a finished appearance and tends to break the monotony. Go over the last coat of varnish with pumice stone and paraffin oil, and if a higher gloss is wanted, use rottenstone and oil *after* the pumice. Wax the desk with several coats of good paste floor wax. Then go over the bottoms of the drawer sides with a cake of paraffin; it makes the drawers slide surprisingly easy.

DUNCAN PHYFE—THE GREAT AMERICAN FURNITURE MAKER

J. I. Sowers,
Director of Industrial Arts,
Miami, Fla.

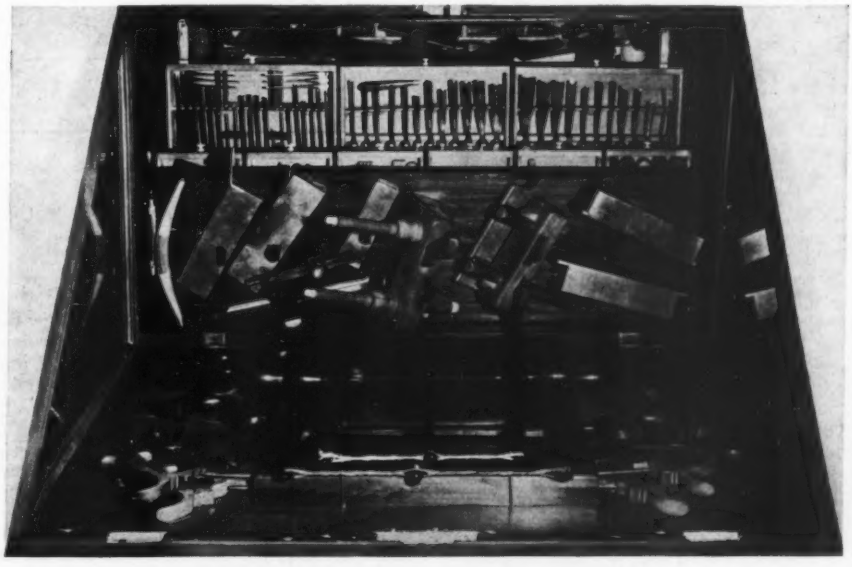
Duncan Phyfe was the outstanding furniture maker in the early days of our republic. He was the first and only man to create a distinctive style of furniture in America. In his furniture we catch a glimpse of the early American aristocracy, as his best work, influenced by Adam, Hepplewhite, and Sheraton, found its way only into the homes of fairly prosperous folk. The furniture used by the poorer class of early American homes, was largely influenced by Dutch and northern European cabinetmakers, and came to be known as "colonial."

The writer has had the opportunity to study the work of Phyfe for several months in the Metropolitan Museum of Art, and also in the museum of the city of New York, in each of which there is a large collection of Phyfe furniture. Yet when one attempts to collect other data about the man it is so meager as to make him almost a legendary figure. There is no picture of Phyfe to be found, and only the most fragmentary of written records. Yet he appears to have lived 62 years in New York City. He did not advertise in any of the papers of the time, or publish a book of his designs as most furniture makers of the better class did in England and France before him. He is said to have been a Presbyterian, yet his name does not appear in any of the contempory church records, and is only found in the smallest of print in the early directories of the city.

The city directory of New York lists the name Duncan Phyfe for the first time in 1792, as a cabinetmaker with a shop at No. 2 Broad Street. Of Phyfe it can be truly said he is known only by his work. He soon became the leading cabinetmaker of the city. The early Knickerbockers prided themselves on the possession of his furniture.

Figure 1 shows chairs which date from Phyfe's earlier and better work. The lyre-back chair is perhaps as graceful and beautiful as any chair ever made. The lyre was a favorite motif of Phyfe and was also used in his small tables, as at *F*, for instance. Such tables were also often supported on the same type pedestal by a series of short turned legs. Such turned parts were frequently reeded after the Adam manner. The pedestal shown at *B* is used both singly for small tables, and in doubles for large extension tables. The use of brass claw feet will be noted on the tripod base of the tables, and the finely proportioned and handsomely carved legs of the sofas. It is in the making of

Fig. 1. Samples of Duncan Phyfe's style



Duncan Phyfe's Tool Chest now in the possession of the New York Historical Society. Photograph, courtesy of this Society

chairs, tables, and sofas that the style of this designer-craftsman is outstanding.

This Scotch cabinetmaker was a master of the beautiful curve. When he used reeding or carving, it was done to augment the beautiful flowing lines of the contour, as is shown at *G*, *H*, and *I*. The Phyfe chair is not structurally strong, yet so well made that many of them have endured a century of use. The sofa at *E* shows a Sheraton influence.

There are a few Phyfe beds still to be found, but they are not common. They are made with ends and rails quite like the sofas, both head and foot being the same height. While the best of the Phyfe sofas are poems of line and curve, the beds seem stilted and lacking in harmony.

In 1846 the firm of Duncan Phyfe and Sons was discontinued and the stock sold at auction. The August 16, 1854, issue of the *New York Times* contains a record of his death.

In Figure 1 are pictured some of the outstanding details of the Phyfe style.

At *A* is shown a lyre-back chair, at *B* a pedestal with claw foot and wheat motif carving. The chair at *C* has a carved back rail and curved crossbars with medallion at intersection. *D* shows a front view of lyre-back chair, and *E* one of the less familiar types of the Phyfe sofa. A table with partly lifted top to form a wall stand, is shown at *F*. By letting this top down and giving it a quarter turn this could be made into a small extension table. At *G* is pictured a carved sofa leg with brass claw foot. A rather elaborately carved foot, somewhat Rococco in design, is shown at *H*, and a sofa foot of Grecian symplicity and beauty at *I*. An eagle-wing carved foot, surmounting a lion's claw, is shown at *J*. This type of foot is found on a sofa used in Mr. Phyfe's own household.

ELECTRICAL TRICKS FOR EXHIBITION PURPOSES

Wynne L. McDougal,
Head, Dept. of Electricity,
Pullman Free School of Manual Taining,
Chicago, Ill.

Frequently the school shop is asked to put on an exhibit in order to show some of the interesting things that are being done. A general display of this type may, for instance, be put on for the *open-house* evening.

Teachers of electricity often find that their really worth-while jobs have little appeal to attract and hold the attention of the visitors hurrying through the shops on these occasions. While, perhaps, most of these visitors are not so technically minded that they wish to stop and study an intricate winding, they are, nevertheless, genuinely interested in the work done by their sons, even though this work may be too perplexing for the parent to appreciate in the short time he may have at his disposal.

It was felt, therefore, that there should be an exhibit of a more spectacular nature to go along with the regular work exhibit, so that those having merely a passing interest would have something by which to remember the electrical shop.

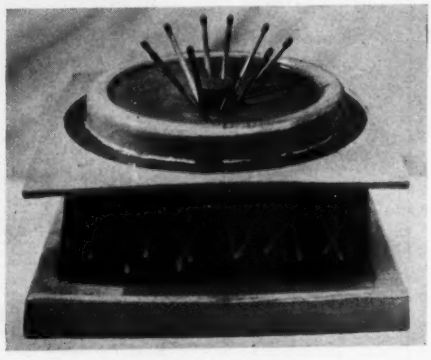
For this reason then, a special room was prepared in the electrical department in which, among the completed work, could be exhibited a variety of *trick* devices. These were designed to embody the fundamental electrical and magnetic effects that are the foundations of all electrical power, even though the device itself is simply that of entertainment.

It may be surprising, but through the years these trick exhibits have drawn more and more of a crowd each year, and they have certainly justified their existence. It might be said though, that while this room is always crowded on these occasions, there are also visitors of a more serious-minded type who spend time in the other rooms of the shop, observing the really complicated things that the teacher rates important.

Feeling that other instructors of electricity may be interested in this type of exhibit, several trick experiments are herewith presented.

Animated Matches

This act is built around the fact that if small nails, or brads, are arranged around



Animated matches

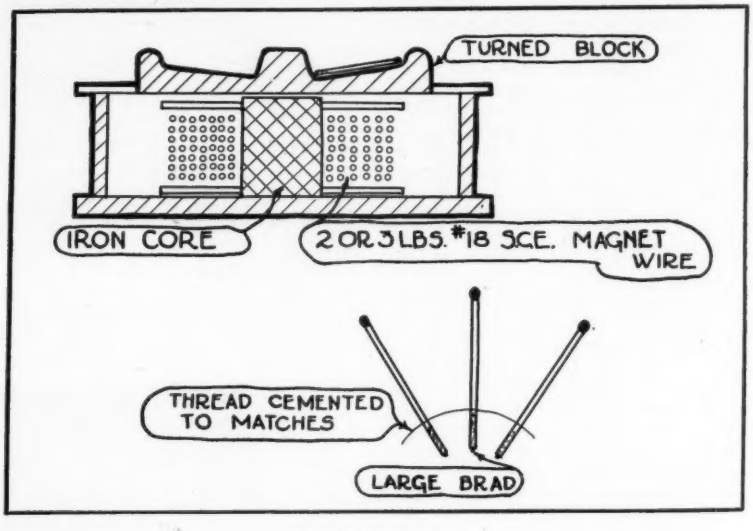
the top of the core of an electromagnet of sufficient power, they will tend to stand erect when the current is turned on and fall back into the reclining position when the current is turned off.

Of course, if the brads are concealed in the ends of the old-fashioned, wood-stick matches, and if the magnet is itself concealed from view, it ceases to become a natural understandable magnetic action, and has the appearance of a magic trick. At least that is the reaction we get from the throngs at our exhibit tables during our annual open-house evening.

An act of magic is a simple thing when explained. Much too simple we think, at times, to waste our time on them. But a good one goes over big with an audience, and a magician rarely explains his act. This one will interest the children, however, and it will be the older ones as well as the young ones.

This device, as well as the others of this series, shows off better when actuated by some kind of automatic timing device. This makes the action entirely automatic and spaced the proper distance from the action in the others. To this end the simple timing device which we use will be explained at the end of the series.

There are no exact specifications given on the sketch, because we have felt they are not really needed, the size of the turned block being held to certain limits by the size of the spool of the magnet and the length of the match. It is suggested that it be turned so that the matches are slightly elevated at the outer ends. It requires much less work to lift a match from this inclined position. An iron core of perhaps 2 in. in diameter is also suggested. The spool ends can be fitted directly to this, the core insulated with heavy insulation paper and the wire wound on. You will need an indefinite amount of wire, because the permeability of the core that you will use, is not known. Neither is the thickness of the turned block, nor the size of the brads. But this doesn't make so much difference. If your completed magnet draws a little too much current from your 110–120 volt, alternating current line, then add a little more wire. If it draws only a small amount and the performance isn't as good as you like it to be, take off a number of turns.



Animated matches

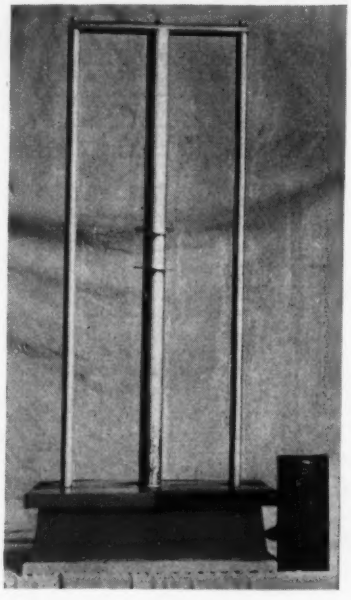
It is also suggested that the matches be confined somewhat in their positions in the circle by a thread cemented to each near the brad end, as shown in the sketch. This will keep them in line when they fall back into the rest position.

The Jumping Ring

This Jumping Ring Exhibit is an electromagnetic effect employed in the squirrel-cage induction motor.

In this experiment, there is a heavy magnetic field set up by the electromagnet around the pipe at the base. The pipe itself helps to extend that field in the direction you would like it to be extended and also forms a guide to keep the ring in control, and to return it to its proper place when the current is cut

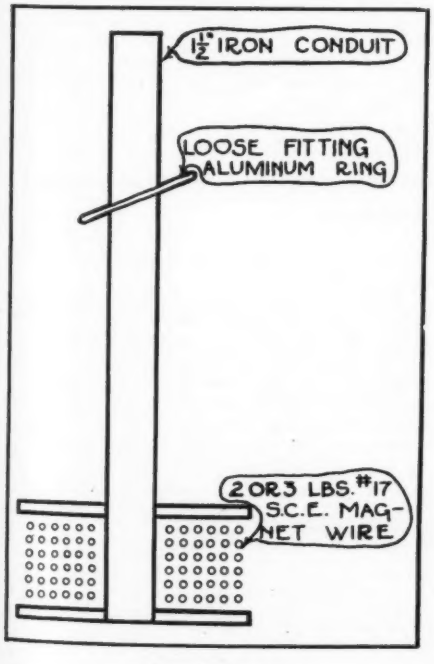
off. The ring itself is a conductor, a coil of one turn, and it lies in the field of the energizing coil at the base of the pipe. The lines of force, therefore, cut through it causing a current to be set up in the ring. This current in the ring sets up its own magnetic field



Jumping ring

which, by the laws of induction, oppose the field of the first magnet. Since the ring is free to move, and the law of magnetism says it must, it moves on up the pipe out of the field of the first magnet until it reaches a spot where the magnetic forces just balance, there it stays suspended until the current is cut off.

As in the description of the animated matches few exact dimensions are given. This device will however, draw more current than the magnet of the animated matches device,



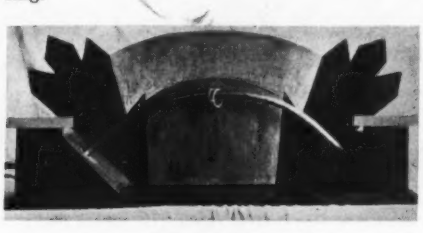
Jumping ring

but it need not be built to draw an exceptionally large amount. It has been used in several other places besides our school for exhibition purposes, and has never blown any fuses. Once when it was to be used in the downtown section of Chicago, where direct current only was available, a small converter was used. In order to get the smallest possible current consumption, the outer pipes shown in the half tone were put on. This reduced the current without reducing the action of the rings. It did this by creating an easy return path for the magnetic lines from the top of the pipe, and created enough reactance to slightly reduce the current.

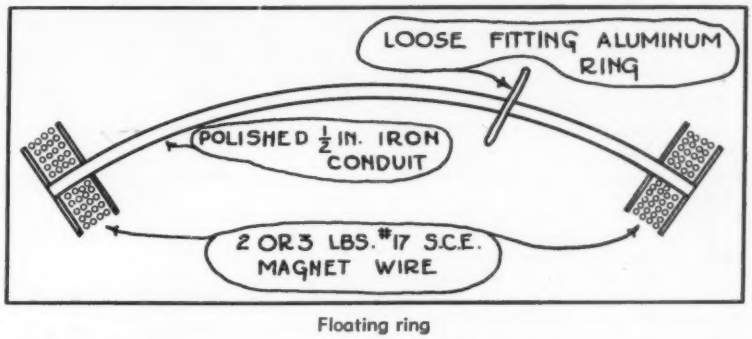
It is suggested that aluminum be used for the ring. As fas as conductivity of the material goes one could choose copper, but a copper ring is heavier than an aluminum one, and will not come to rest as high up on the pipe as does the one of aluminum.

Floating Ring

The third device in this electrical-trick series is the floating ring. It is, in fact, a somewhat changed version of the jumping ring.



Floating ring



Floating ring

The core is made of ½-in. conduit, polished, somewhat curved, and placed in a horizontal position. There is a coil on each end, and when the current is turned on in one coil the ring ascends the arc formed by the pipe, passes over the crest and comes to rest against the face of the other magnet ready to repeat the action, in the reverse direction, when the current is applied to that magnet.

In order to get the fullest and best effect, this device should have the circuits of the coils attached to a positive timing device. The animated-match device may be placed in front of the floating ring, and the hookup to the automatic switch so arranged that the ring passes from one magnet to the other, the matches rise and fall and the ring passes back to the first magnet, after which the matches rise and fall again. With a positive timer, this action is repeated continuously and as regular as clockwork.

These devices have created a great deal of interest wherever shown. They are not toys with little value, for they demonstrate important magnetic principles, especially the two with the rings. Because of this, they may be looked upon as important instructional devices.

A LATHE STAND

Herbert K. Iverson,
Lincoln High School,
Seattle, Wash.

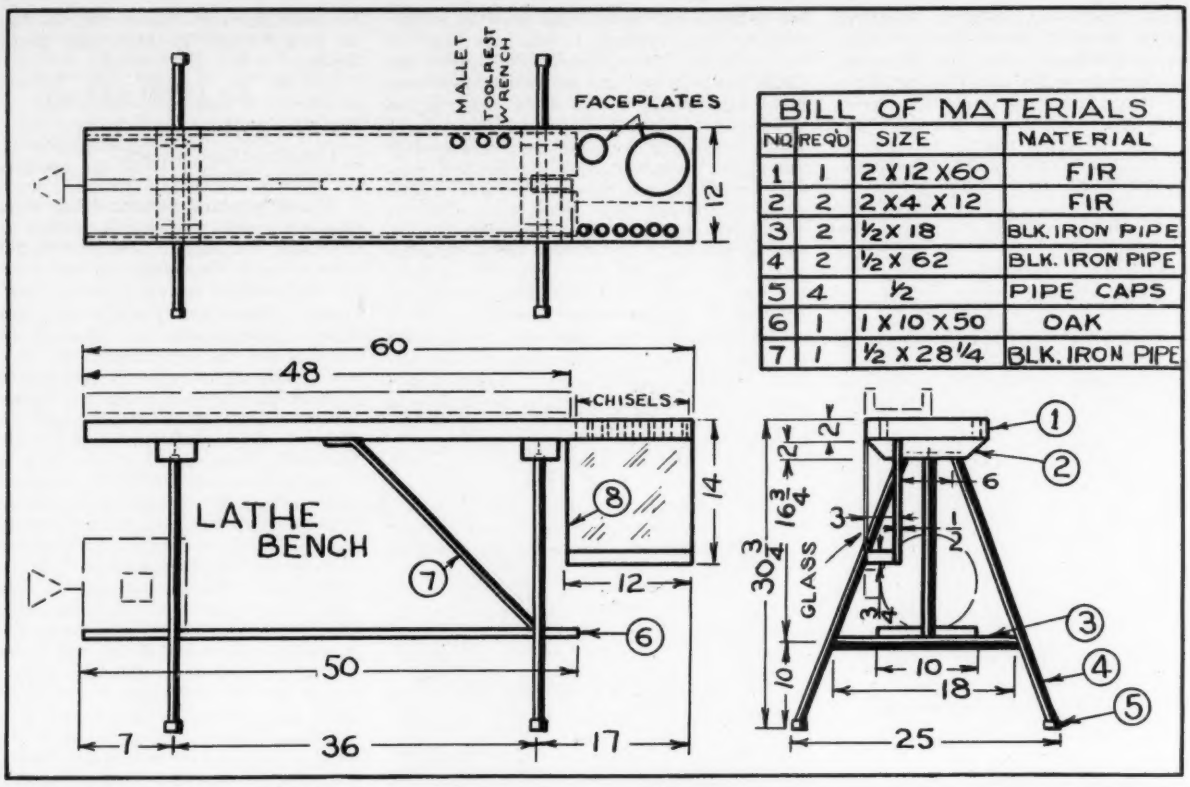
The lathe stand presented herewith is being used with considerable satisfaction because of the simple, strong, and adaptable construction. Wood was at first considered, but was decided against in view of preferable metal construction. Consideration was also given to the requirements of the pupils who were to use the equipment.

Of particular interest is the method used to hold the chisels conveniently within reach of the operator. It is not only convenient but also provides a permanent and safe place for the tools where damage to them or pupils is less likely to occur. The other equipment such as faceplates, wrenches, and the like, are likewise placed within easy reach. Adjustment of belt length is obtained by shifting the motor sidewise to take up the slack. The height of the lathe in this case is suitable for junior high school boys and should be slightly increased for senior high school use. Finally it is well to mention that the stand was made to accommodate the Delta lathe, however, by adjusting the dimensions it can be changed to fit any standard lathe or other equipment requiring support. As a matter of fact, the same stand has been adapted to be used with the Delta jig saw in our woodshop.

Black iron pipe in 16-ft. lengths was used, each piece being sufficient to make one stand. The bill of material lists the exact lengths of the various pieces used, besides designating the materials to use.

Method of Procedure

1. Draw the design of the stand ends, full size, on the floor or other suitable place.
2. From these drawings determine the lengths needed.
3. Cut the three pieces to make the two ends and the brace.
4. A forge will be required heating some of the pieces.
5. Bring each mid-section of the end pieces to a suitable temperature after which each is placed in a vise and squeezed until the section is flattened. At the same time bend the ends to fit against pieces No. 4.
6. Treat the brace in the same manner except in this case heat only one end.
7. Drill the necessary holes in each piece.
8. Thread the ends of the standards and screw on the pipe caps as shown at 5.
9. Rabbet out the crosspiece, parts No. 2, and bolt on the standard.



BILL OF MATERIALS

NO.	REQ'D	SIZE	MATERIAL
1	1	2 X 12 X 60	FIR
2	2	2 X 4 X 12	FIR
3	2	½ X 18	BLK. IRON PIPE
4	2	½ X 62	BLK. IRON PIPE
5	4	½	PIPE CAPS
6	1	1 X 10 X 50	OAK
7	1	½ X 28 1/4	BLK. IRON PIPE

10. Drill the holes in the top and bolt it onto the crosspieces.

11. Bolt the motor onto piece No. 6, fitting the latter to fit around the brace No. 7.

12. Clamp the motor and support in place after the crosspieces No. 3 have been welded in place.

13. Drill the necessary holes that are needed for the chisels, faceplates, and clean out holes under the lathe proper.

14. Secure the safety case No. 8, around the lower part of the chisels.

NOTE: The front of this case should be of glass so that the chisels are visible.

15. Paint the stand any suitable color.

16. Assemble the lathe after which fasten it in place.

In case the stand does not stand firmly, adjustment is made by tightening or loosening the pipe caps No. 5.

110-VOLT HORN

W. J. Stinson,
Junior High School,
Auburn, N. Y.

The roar of this foghorn is caused by the vibration of the bottom of the can. When the alternating current from the house circuit flows through the magnet coils, it causes a trembling magnetic field which acts on the steel of the can bottom and makes it vibrate.

It makes an excellent cleanup signal for the shop and has proved to be an attention-getter at boy-scout meetings and fairs. Figure 1 shows how it is assembled.

Materials:

1–5 qt. oil can with top neatly cut off. (Obtain from any gasoline station or garage.)
1 pc. No. 26 Ga. by ¾-in. by 18-ft. silicon sheet steel. (Stove pipe iron or galvanized iron will do.)
1 pc 1/16 by ¾ by 26-in. band iron
4 pc. 3/16 by ⅜ by ⅜-in. r.h. stove bolts
8 pc. 3/16-in. washers

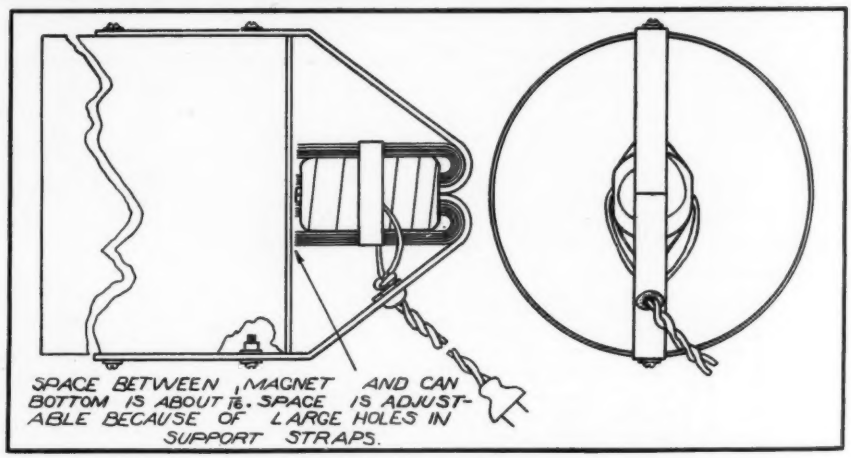


Fig. 1. The assembled horn

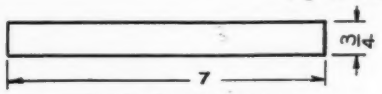


Fig. 2. Core lamniation

1 pc. friction tape, 6 ft. long
1 pc. lamp cord (6 ft. long) with plug
1 pc. composition bushing for lamp cord
1 pc. ⅛-in. pipe lock nut
No. 30 E.S.C.C. magnet wire

Core lamination: Cut the strip of No. 26 Ga. silicon sheet steel into pieces which are 7 in. long, as shown in Figure 2. Use tin snips to do this.

Support strap: Figure 3 shows the straps which hold the magnet to the can. They are made of 1/16 by ¾-in. flat band iron. Two 13-in. pieces will be needed. In one of these pieces drill a 13/32-in. hole 5 in. from one end for attaching the connection cord.

Core assembly: Figure 3 shows how the core is to be assembled. Notice that the pieces are placed so that at one end all are in line. Squeeze them together and bind them

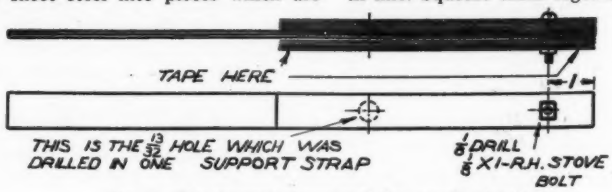


Fig. 3. The support straps and the core laminations

with two layers of tape at points indicated. Center punch at point where hole is to be drilled. Clamp core in vise and drill hole. Put a ⅛ by 1-in. r.h. stove bolt through hole and tighten, saw off bolt flush with top of nut.

Insulating core: Tape is used to insulate the core and to cover the sharp corners before the coil is wound. Cut four pieces of tape about 3¼ in. long. Place on strip on each edge so that it straddles the edge, as is

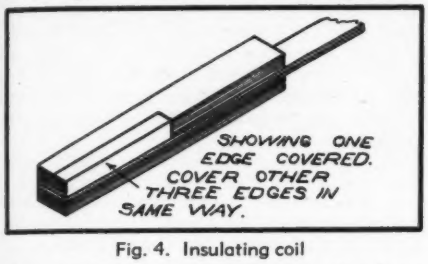


Fig. 4. Insulating coil

shown in Figure 4. After the four edges have been taped, cut four more pieces of tape 7 in. long and place them on the four sides as shown in Figure 5. Notice how these pieces extend over the end of the core. About ¾ in. of each strip is bent over the end so that after the coil is wound, they can be pulled back over the coil.

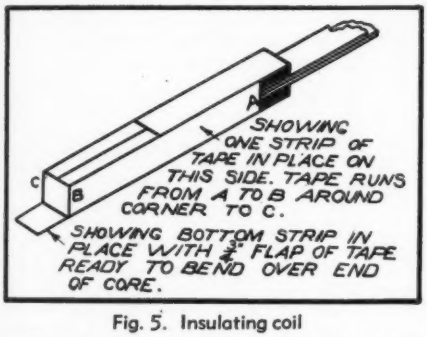

A
SHOWING ONE STRIP OF TAPE IN PLACE ON THIS SIDE. TAPE RUNS FROM A TO B AROUND CORNER TO C.
C
B
SHOWING BOTTOM STRIP IN PLACE WITH ¾" FLAP OF TAPE READY TO BEND OVER END OF CORE.

Fig. 5. Insulating coil

Placing markers: Tie pieces of string around core at points shown in Figure 6.

Winding coil: Figure 7 shows how the 1100 turns of No. 30 E.S.C.C. magnet wire are wound between the string markers.

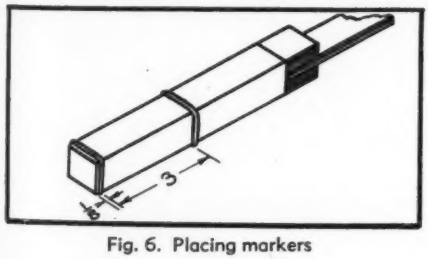


Fig. 6. Placing markers

Drawing tape over coil: After the wire has been wound into place, pull the one strip of tape over the end to hold it in place. See Figure 8. Then test the coil on the test panel

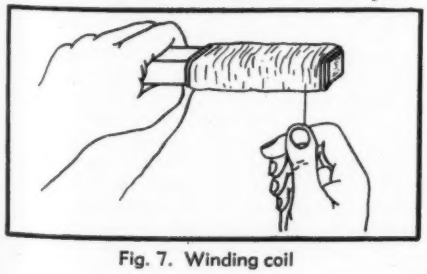


Fig. 7. Winding coil

by connecting a test lead to each of the end wires of the coil. If the wire in the coil is unbroken, the test lamp will light.

Finishing magnet: Next, wrap coil with a layer of tape as shown in Figure 9, leaving about 8 in. of each of the end wires out for connections. Then bend laminations over coil one by one, cutting ends off each with tin snips so that all ends are even. Figure 9 shows how this is to be done.

Final assembly: When all laminations are bent and cut, bend support straps so that they will fit the can and hold the ends of the magnet about 1/16 in. from the bottom

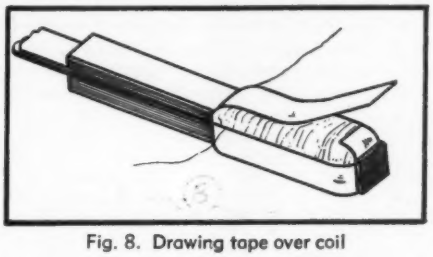


Fig. 8. Drawing tape over coil

of the can. Install a composition bushing and lock nut in the 13/32-in. hole. Put lamp cord through bushing and tie underwriter's knot. Connect one wire to each end of coil. Solder and tape each splice. The splices are further protected by two or three turns of tape which bind them to the magnet. Tape is wrapped tightly to hold laminations in place.

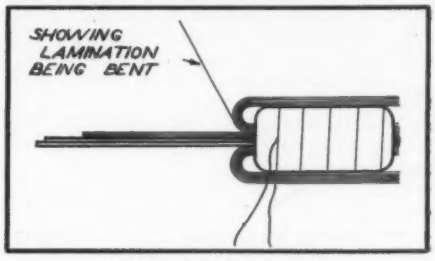


Fig. 9. Finishing magnet

The magnet is held to the can by four 3/16 by ⅜-in. r.h. stove bolts, two in each support strap. Each bolt has two washers. The first bolt may be located about 1 in. from the can bottom and the other one about 1 in. from the end of the support. Center punch and drill ⅜-in. holes at these points. Place some object between can and magnet to get about 1/16-in. spacing (steel rule will do) and mark can through holes. Use hand drill to drill 3/16-in. hole in can. Put in the bolts and washers, plug in the outlet, and adjust the space to get the desired volume. Then firmly tighten the bolts, and the job is done.

NEW SKETCH SHEET FOR DRAFTING ROOM

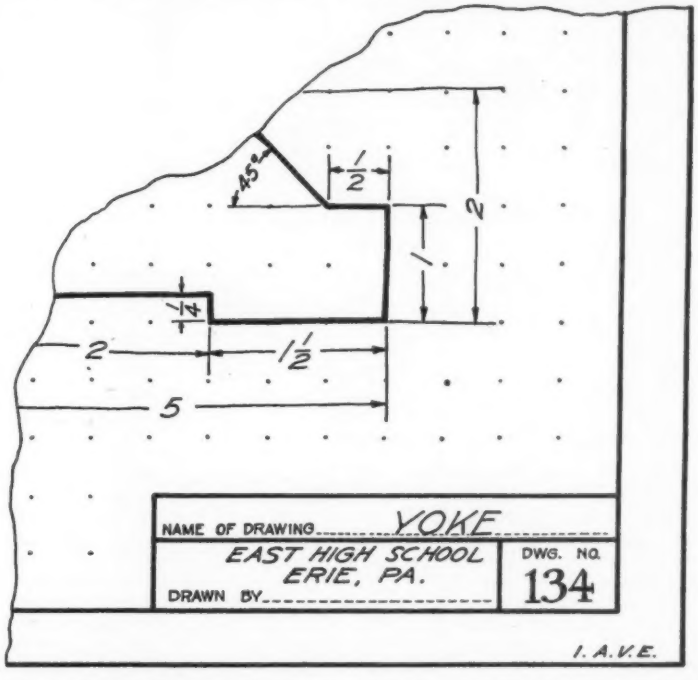
D. E. Kellogg,
East High School,
Erie, Pa.

Cross-section paper is a great aid to the student or draftsman when he needs to make an orthographic sketch, but for two particular reasons it is often not available or recommended. First, the cost of printed section paper is so high that the budget allowance for the school supplies will not permit its use. Second, the crisscrossing of lines on the section paper, even though it helps to judge size and proportion, does definitely detract from the general appearance and readability of the drawing. When plain paper is used the novice at sketching fails to keep his illustrations within reasonable limits of size or proportion.

For the past three years, the substitute for section paper shown herewith has proved to be most satisfactory. It is mimeographed from a stencil prepared as follows:

1. Lay out on an 8½ by 11-in. drawing sheet the desired border line and title.

2. Draw accurately horizontal and vertical lines to fill the entire remaining drawing space at ½-in. intervals or any other desirable uniform spacing.



3. Place this master sheet under the stencil sheet and after tracing the border and title

with a stylus or the smoothly rounded point of a hard pencil, prick a point through the stencil at the corners of each square drawn on the master sheet. The shouldered end of the compass centers may be used for this purpose making the holes all uniform in size.

From a stencil prepared in this manner thousands of sketch sheets may be printed, and by blotting off the ink after the stencil is used, it may be kept and used for three or four successive printings.

With this section paper available, the student takes more interest in his work and has a real feeling of pride in the workmanlike appearance of his finished sketches.

Please note in the accompanying sketch that the tiny dots in the background of the paper do not detract from the readability of the sketch.

RADIO AND INDUSTRIAL ARTS

Carleton E. Beck,
Lockport, New York

Radio is taking a large and important place in our daily lives, and with television already being offered in a few of our larger cities, the opportunities in the radio field are steadily increasing.

Industrial-arts teachers have sadly neglected this branch of activity, and something ought to be done about it. Some may say, "Leave it up to the teacher who has made a hobby of radio. It is too difficult for me to learn and put it across to my students," or, "Why try to teach something I don't know anything about," or, "I'd have to go to summer school or a radio school to learn something about it," or, "Why make receivers when they can be bought so cheaply; by the time a student gets through making one it costs him about as much as one already built." All of these statements are of little value when one considers the information the student receives from a study of the radio, and how he will learn to appreciate the careful planning and skill required for the assembly of our modern receivers, and of the entire art and science of radio.

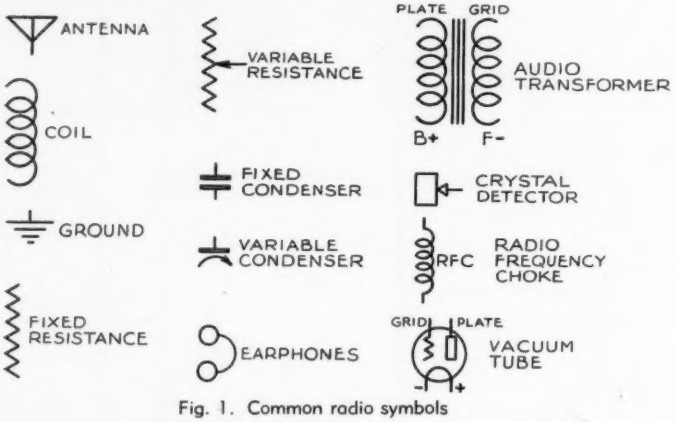


Fig. 1. Common radio symbols

Getting back to the teacher's ability in teaching the rudiments of the subject and the assembly of a small 1- or 2-tube receiver — with the few hints given in this article, and the small outlay of money required to buy a *Radio Amateur's Handbook* published by the American Radio Relay League, much related information, theory, and practical knowledge may be obtained with a few nights of hard study.

There is, of course, some information that sounds quite technical, but the few hints embodied in the following diagrams will aid one in getting started.

1. The beginner should know the common radio symbols shown in Figure 1 in order to understand construction.

2. He should know how to solder. *All* joints in a radio circuit should be made with *Rosin Core Solder*, to prevent leakage of radio frequency currents.

3. When the symbol shown in Figure 2 is seen in a radio diagram, it represents a "plug-in coil" of the four-prong variety.

4. Knowledge of a tube or coil socket should be memorized. It will always be like the sketch shown in Figure 3.

5. The holes of a five-prong socket are labeled as shown in Figure 4.

6. In a variable condenser there is a set of Rotor and Stationary (stator) plates: The arrow shown in Figure 5 always means the rotor plates. In a circuit where one set of plates is to be grounded, it should *always* be the rotor plates.

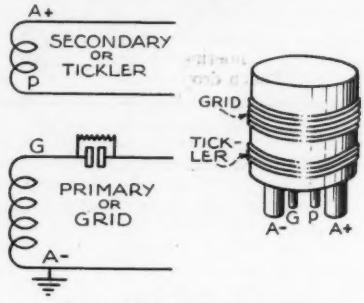


Fig. 2. This is a plug-in coil

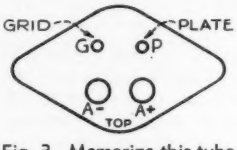


Fig. 3. Memorize this tube or coil socket

7. To make it easier for a student to wire a receiver from a diagram, the parts should be placed on the board or chassis according to the directions on the kit or picture. One thing should always be kept in mind, and that is, to have the parts fairly close so the wiring will always be as short and direct as possible.

Now sit down and draw a sketch of the assembled parts on paper showing the sockets with the holes, variable condensers, resistors, and the terminals for the leads off the back of the receiver.

Example: A one-tube all-wave receiver. Figure 6 shows the schematic diagram, and Figure 7 shows a sketch of parts and how they are wired.

8. Many home-built receivers fail to work due to the result of poor construction and lack of knowledge of coil winding. This is the most important part of the set. The following few important hints should always be faithfully followed.

The wire on both the primary (grid) and secondary (tickler) coils should *always* be wound in the same direction unless otherwise specified. Both coils are wound on the same form, with the tickler coil on the *bottom* and grid coil wound on the *top* of the form. A space of ⅛ in. between them is usually sufficient. A sketch of how the connections are made to the prongs of the coil form is shown in Figure 8.

a) The lead that goes to the plate of the tube should always go on the *extreme* bottom.

b) The lead that goes to the earphones (or transformer if an amplifier is used) should always be the second from the bottom.

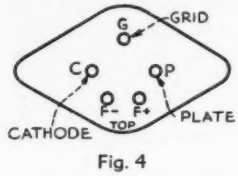


Fig. 4

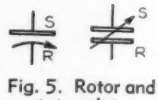


Fig. 5. Rotor and stator plates

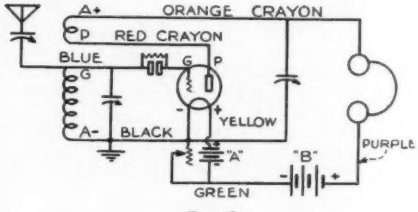


Fig. 6

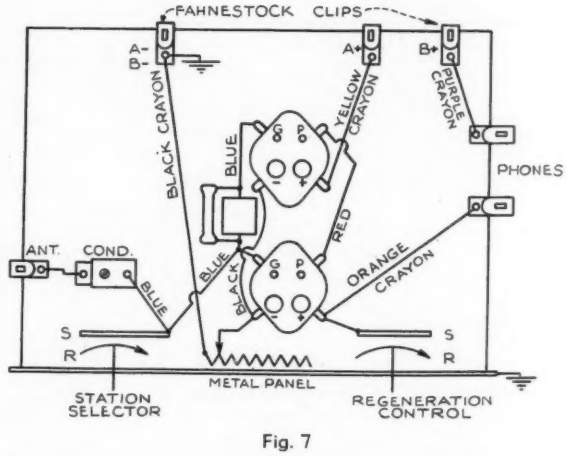


Fig. 7

c) The third from the bottom should go to the ground (or chassis).

d) The top always goes to the grid condenser of the first tube (detector).

Exact specifications for coils will not always function in two different sets due to the variation of wire lengths in wiring the receiver.

To obtain oscillation (a whistle), proper relation between grid and tickler coils must be obtained. To induce oscillations, regeneration controls are used, either variable condensers or variable resistors. These plus the number of turns on the tickler coil determine oscillations. A few hints follow:

a) If set does not "plunk" when the *stator* of the variable condenser for regeneration is

touched and released; or, in case a variable resistor is used, if the terminal going to the *tickler* winding is touched; it is necessary to add a turn or two to the tickler winding. The proper position where oscillation occurs should be when the control is about half way in.

b) If a set squeals all the time, take off a turn or two on the tickler winding.

c) If the receiver is wired properly when the grid of the tube is touched the set should squeal.

A sample instruction sheet on winding coils, follows.

How to Wind Radio Plug-in Coils

It is necessary to have a group of coils with various numbers of turns to enable a short-wave receiver to cover the entire radio spectrum. To decrease the capacity, and to properly receive short-wave stations that are crowded closely together, small variable condensers are used. Care must be taken to wind these coils or the receiver will refuse to function, especially on the shorter waves.

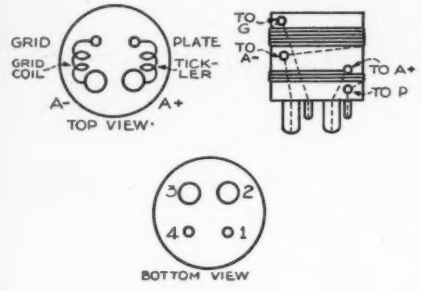


Fig. 8

This shows how the grid and tickler coils are connected to the various prongs.

With a box of assorted colored crayons, draw in the wires to the various parts using a *different* color for each and every wire and at the same time draw a *like* color on the schematic diagram so he will learn the resemblance of each to the other. This should be done a wire at a time, if preferred, so he can make his connections on the receiver. This method makes it easier for him to learn how to read schematic diagrams.

1. Pick up the coil form and hold it looking at the bottom (see Fig. 8).

2. Hold it toward you and number it 1, 2, 3, and 4 respectively as shown.

3. With points 1 and 2 held toward you, as shown in Figure 9, measure up ¼ in. from the bottom and drill a 3/32-in. hole and label it No. 1.

4. See how many turns are required for tickler coil and estimate how far from the

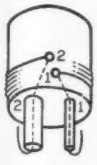


Fig. 9

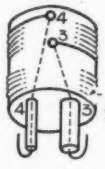


Fig. 10

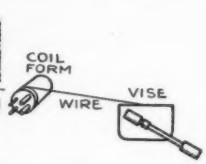


Fig. 11

first hole you will drill hole No. 2. After drilling the second hole, you are ready to start winding the tickler coil.

5. Clean off about 1 in. of insulation from end of wire. Thread it through bottom hole of form and down through prong No. 1. Bend up as shown in Figure 9.

6. Unroll some wire and pinch one end of it in the vise as shown in Figure 10. Pull tightly and wind the coil, counting each revolution until you have reached the required number of turns. Allow about 6 in. for the connection and cut off the wire. Hold the end tightly and scrape a spot where it will make contact with prong No. 2. Push wire down through top hole and down through prong No. 2. and bend up as shown in Figure 9.

7. We are now ready to wind the grid coil. Turn coil form around so that prongs No. 3 and 4 are toward the front (see Fig. 10). About ⅛ in. above tickler coil drill a 3/32-in. hole. Figure the number of turns needed on grid coil and drill the top hole between No. 3 and No. 4. Thread wire through bottom hole and down through No. 3 prong. Bend up. Start winding as before until right number of turns have been reached. Scrape spot bare on wire, push it through hole and down into prong No. 4 (see Fig. 10). Be sure to wind grid coil in same direction as tickler coil or the coil will not oscillate in the receiver.

8. Heat the soldering iron. Hold prong on end of iron. Touch drop of solder to iron, and the solder will run up hole in prong. Repeat on the four prongs.

9. Clip wire close. File smooth. Sandpaper.

10. Plug coil into coil socket. Turn regeneration control about ¾ of the way in. Touch finger to stator plates of station selector condensor. If, by touching and releasing, a *plunk* in the earphones is produced, the coil is oscillating. If it will not oscillate, then add a turn or two to the tickler coil until it does. If coil oscillates with regeneration control all the way out, remove a turn at a time from tickler coil. Coils to work properly should start to oscillate when regeneration control is halfway in. (Exact specifications cannot be given for all receivers, due to the variation in the wiring and relation of parts to each other).

HELICAL GEARS

George J. Frey,
Ohio Mechanics Institute,
Cincinnatti, Ohio

This type of problem in helical gears presented itself in the following form: To determine how many diameters of helical gears can be cut successively from a given diameter of bar by cutting the teeth, and then, if the job be discarded, by cutting down in lathe to root diameter, cut the next smaller size gear, repeating the process until the bar is used up.

The following limitations were imposed on the job: Only one set of change gears is available for cutting lead; one dividing head index plate is available, limiting num-

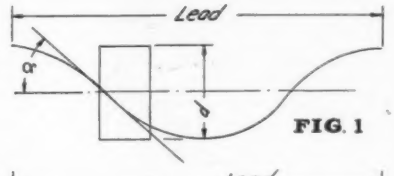


FIG. 1

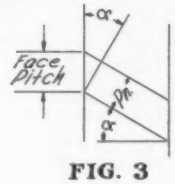


FIG. 3

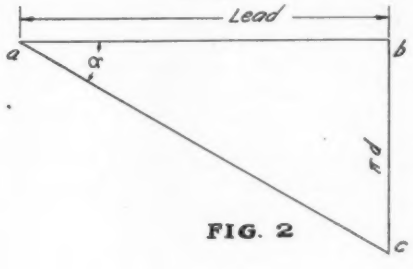


FIG. 2

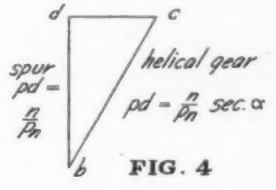


FIG. 4

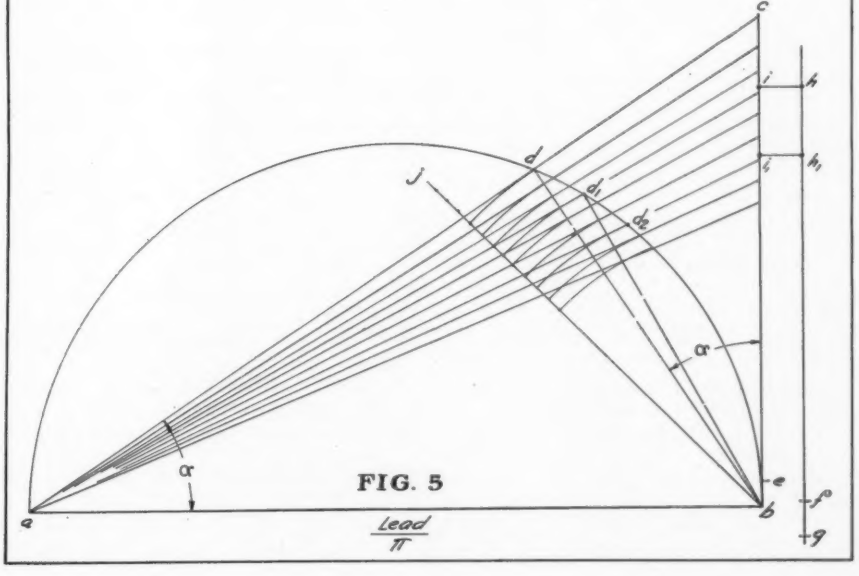


FIG. 5

ber of teeth; and only one set of cutters is available, limiting pitch.

The lead is fixed by change gears and answer to equation:

$$\frac{\text{lead}}{10} \times \frac{\text{2nd cut} \times \text{gear on worm}}{\text{1st cut} \times \text{gear on screw}}$$

Pitch diameter of gear

$$= \frac{\text{no. of teeth} \times \sec \text{helix angle}}{\text{dia. pitch of cutters}}$$

$$= \frac{n \sec a}{Pn} \quad (1)$$

Lead of gear $= \pi \times$ pitch dia. $\times$ cot. helix angle $= \pi d \cot. a$ (2).

As a check on No. of teeth or lead, (1) and (2) can be combined:

$$\text{Lead} = \frac{\pi n \sec a \cot a}{Pn} = \frac{\pi n \operatorname{cosec} a}{Pn}$$

$$\text{or } n = \frac{\text{lead} \times Pn}{\pi \operatorname{cosec} a} \quad (3).$$

Determining the successive gears from (1) and (2) and (3) is a tedious process since it is mostly cut and try, always more than one unknown being present. Therefore the equations have been reduced to the diagram shown.

Figure I shows the helical gear with important items; pitch diameter (pd), helix angle, a; and lead.

In Figure II these have been rolled out into a right triangle of lead, helix angle, and pitch circumference of helical gear.

Figure III shows how pitch of the cutter enlarges to circular pitch $\times$ sec a for a helical gear.

Figure IV shows how diameter of a spur gear enlarges to the diameter of a helical gear; viz. $\frac{n}{Pn} \sec a$.

The triangles of Figures II and IV are similar.

In Figure V, *ab* (lead) of Figure II has been reduced to $\frac{\text{lead}}{\pi}$ and *bc* of Figure II has been reduced to $\frac{\pi d}{\pi} = d$. Place Figure IV into Figure V so that *cb* of Figure IV falls on *cb* in Figure V, then point *d* of Figure IV will fall on line *ac* and angle *cdb* of Figure V will be a right angle. Using *ab* as a diameter draw a semicircle *adb* and point *d* previously established from triangles will be an the semicircle. All the above can be demonstrated from plane geometry.

Draw a line *bj* at random from *b* and on it lay off spaces representing gear teeth to scale for given diametrical pitch. This corresponds to the pitch diameter of a spur gear. Draw arc from points on *bj* to the semicircle, using *b* as center, and distances from these intersections to *b* will represent equivalent spur gears of varying numbers of teeth. If, then, lines are drawn from point *a* through intersection points on circumference of semicircle to line *bc*, the distance from intersection on *bc* to point *b* will give the diameters of helical gears, from a helix angle a and a fixed lead $ab \times \pi$.

To revert to the problem stated at the outset. Let *cb* in Figure V be the pitch diameter of the first helical gear. Lay off *be* equal to two dedendum heights. Then *ec* equals the root diameter of this helical gear, and this will serve as the outside diameter of the next smaller gear. Draw *hfg* parallel to *ceb*. Layout *fg* equal to two addendum heights. From *g* lay off *gh* = *ec*. Opposite *h* is *i* and *ib* is the pitch diameter of the next smaller helical gear. The chart may indicate a fraction of a tooth. The user must choose the next smaller whole number of teeth. The process just described can be repeated until the cylinder has been worked to its smallest usable diameter.

This diagram is, of course, approximate, and arithmetical calculations, using the formulas (1), (2), and (3), must be made as an accurate check. The diagram gives, however, a very close first approximation, and a good perspective of the variables involved, while a first attempt with equations only (barring considerable experience) will be a mere guess, with practically no clue as to the direction in which the variables are moving.

EVERYDAY MISTAKES WHICH SOME STUDENTS MAKE IN WOODWORKING

ARE YOUR STUDENTS GUILTY?

M. H. Perkins,
Williston Industrial High School, Wilmington, N. C.

1. Gluing boards together without fitting them properly.
2. Gluing members of a project without planing and sanding them.
3. Cutting material to length without squaring it.
4. Cutting on the line instead of side it.
5. Boring holes without sighting them.
6. Making hammer marks on your work while nailing.
7. Using glue that is too thick, too thin, or too cold.
8. Nailing easily split material too close to the end.
9. Sanding material without planing it.
10. Using hammer for mallet.
11. Countersinking screw holes too deep.
12. Tearing the slot out of roundhead screws.
13. Putting screws into hard or brittle wood without making holes for the screws.
14. Cutting duplicate parts by measurements.
15. Ripping material without allowing for planing.
16. Cutting material without any thought of economizing.
17. Cutting material without any thought of using the best portion.
18. Attempting to make a project without making a drawing.
19. Trying to do a good job with a dull tool.
20. Marking out and cutting irregular curves without the use of a templet.

ANSWERS TO QUESTIONS

PRISCILLA MAPLE FINISH

1077. Q.: I am anxious to duplicate the so-called "Priscilla" finish on an end table to match other pieces of furniture in the room. Will you kindly advise me as to the type, amounts, etc., of stains to use? — *M. E.*

A.: The color "Priscilla Maple" is a product of the Haywood-Wakefield Co., Gardner, Mass. This consists of a light amber or deep Honey Maple stain over which is ragged a color stain glaze subsequently wiped out to give a high-lighted effect.

If you do not wish to make up the stain to keep on hand, you may buy the color direct in powder form from the Pylam Products Co., 799 Greenwich St., Brooklyn, N. Y. This firm sells the water soluble dyestuff in pounds or half pounds. Do not use over two ounces of this powder per gallon of hot water. If your tap water is of the "hard" variety, use hot distilled water. Try out on a sample piece of properly sanded maple, in both one ounce and two ounce values, for a close match.

In case you have dyestuffs at hand or available then use this formula: metanil yellow, conc, 14 grams; orange A, 20 grams; black, J. W.S., 5 grams; water, hot, 1 gal.

Prepare the maple by sponging and drying overnight, being careful to avoid touching the wet wood with the hands or dark spots will develop, necessitating a bleach. Sand with 4/0 paper to eliminate all scratches and other imperfections since maple must be well prepared for a thin finish. Apply the stain with a clean, rubber-set brush. Let dry overnight, then glaze with a color made of equal parts of burnt sienna and burnt umber ground in oil and stirred into a glazing liquid made of: boiled linseed oil, 2 oz.; flat varnish, 4 oz.; pure turpentine, 1 oz.

Wherever the surface is to be high lighted with the glaze, keep the color away as much as possible in order to avoid the extra work of ragging off. The glaze should be made very thin and allowed to set a minute before it is wiped off with clean rags. Let dry overnight and then apply a clear floor varnish, four-hour type, preferably by spraying. If the glaze color proves too dark on the sample, then use a sealer coat between the dried stain and the glaze. For the sealer, use white shellac reduced with four parts of denatured alcohol and then poured *into* an equal amount of shellac mixing lacquer cut with one part of lacquer thinner. Brush or spray this on thin and even, allow to dry and then sand with 6/0 garnet finishing paper. Follow with the glaze which will wipe or rag off quite differently than in the first instance. It is best to try both methods on complete sample boards.

For the final finish apply a second coat of floor varnish over the well-sanded first coat. Dry hard and rub with FFF pumice stone and crude oil, or golden paraffin oil. Wipe clean and after drying overnight wax and polish. — *Ralph Waring.*

NEW PUBLICATIONS

The Meter at Work

By John F. Rider. Cloth, 152 pages, 5¼ by 8½, illustrated. Price, $1.25. Published by John F. Rider Publishers, Inc., 404 Fourth Ave., New York City.

The objective of this book is to present to the student a thorough understanding of the working principles and uses of the many different types of meters which are now used in the field of electricity, especially in radio and its allied industries.

The 10 chapters present the text material under the following headings: general considerations, moving-iron meters, moving-coil meters, electrodynamometer meters, the electrostatic meter, thermal meters, components of meters, character-

(Continued on page 12A)

NO BETTER BUILT THAN OLIVER NO. 217 BAND SAW

Hollow Chisel Mortiser

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Double Arbor, Motor Arbor, Tilting Saw Bench

24-in. Single Surface Planer

6-inch Hand Planer and Jointer

Every "Oliver" machine tool is built to give outstanding service wherever it is installed.

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With pardonable pride in the service and accomplishment of "Oliver" Woodworking Machinery, we point to the more than 2,100 school shops equipped by "Oliver."

In this outstanding service of "Oliver" Woodworking Machinery to the hundreds of thousands of trainees in the school shops, the "Oliver" No. 217 Band Saw leads the "Oliver" line. Note the specifications.

The "Oliver" line of woodworking machinery includes:

- Speed Lathes
- Circular Saw Benches
- Cut-off Saws
- Band Saws
- Band Saw Brazers
- Jig Saws
- Surface Planers
- Jointers
- Boring Machines
- Mortisers
- Shapers
- Sanders
- Wood Trimmers
- Oilstone Tool Grinders
- Woodworkers Vises
- Glue Heaters

Ask for circulars of any woodworking machines that interest you. Consult us on your shop layout and equipment problems.

The No. 217, 30-inch Band Sawing Machine has automatic brake for the upper wheel; the most complete guarding of all moving parts; the enclosed, oil immersed, self-locking tilting device for the table which tilts 45° to right, 10° to left; the dependable tension indicator; the foot brake which shuts off the current and stops the machine quickly; the dust collecting system; capacity 29¼" between saw and rear guard, 15" under guide; one piece cored frame; disk type wheels; upper wheel aluminum; motor on shaft—and many other important, useful, modern features make this Band Saw without a peer.

Oliver Machinery Company
Grand Rapids, Michigan, U.S.A.
HIGH GRADE MACHINERY

Practically Indestructible

No. R-40 . . . special rubber composition handle, formed under heavy pressure. Fills in the specially designed recesses on the shank to make a handle practically impossible to loosen. Twelve blade widths: 1/8" to 2".

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TRADE MARK

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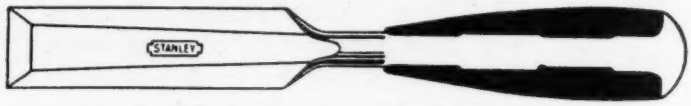
A "Boy Proof" Stanley Chisel is built to stay together. The handle surrounds the single piece of steel which extends from tip to tip, eliminating trouble due to lost or broken handles.

The blades are of the finest steel, tempered with newest heat-treating methods, producing keen cutting edges—edges that stay sharp. A chisel that fits the hand and has a fine balance. Write for catalog 34 describing the full line of Stanley "Boy Proof" Tools.



This cutaway view shows the everlasting construction of Stanley Chisels. The head, shank, ferrule and blade are forged complete — no mechanical joints. A blow struck on the head is transmitted directly to the cutting edge.

STANLEY TOOLS
Division of The Stanley Works
EDUCATIONAL DEPARTMENT, NEW BRITAIN, CONN.

(Continued from page 262)

istics of meters, rectifiers and thermocouples, practical applications of meters.

The book is constructed in an ingenious manner. The pages are split so that the upper part of each page presents an illustration. The lower part of the pages carry the explanatory material. In this way any illustration can be brought opposite the page for which it may be needed.

Practical Job Pointers

By Nelson L. Burbank. Cloth, 129 pages, 8¾ by 11¼, illustrated. Price, $2. Published by Simmons-Boardman Publishing Corp., New York, N. Y.

This is a compilation of shop kinks and short cuts collected from many sources for carpenters and craftsmen working in the building trades. The material is not only helpful, but makes very interesting reading.

The contents has been divided into nine chapters under the following headings: tools, use and care of; workbenches, attachments; portable equipment; excavations, foundations, forms; sills, girders, joists, subflooring; exterior wall construction, inside wall framing; exterior wall covering; roof construction, bay construction, roofing; cornices, porches; interior wall covering, interior trim; steps, stair construction; windows; doors; closets, shelves, built-in equipment; finished flooring; painting, finishing; screen repairing, screens; sanitary equipment; electrical wiring; scaffolds, ladders, hoists; garage doors; and short cuts in laying out work.

Applied Drawing and Design

By E. H. Mattingly and Everett Scrogin. Paper, 224 pages, 8 by 10¾, illustrated. Price, $1.28. Published by McCormick-Mathers Publishing Co., Wichita, Kans.

This is quite a comprehensive mechanical-drawing text. It is divided into 16 units which treat the subject under the following headings: working equipment; beginning to draw; lettering; alphabet of lines and symbols; measuring and dimensioning; views, shapes and positions of objects; mechanical and pictorial sketching; machine drawing; woodworking drawing; sheet-metal drawing; architectural drawing; graphs, charts, and maps; inking and finishing drawings; tracing and blueprinting; some essentials of design; and color. The appendix contains the following: terms and definitions, abbreviations, decimal equivalents, useful rules and tables, bibliography, and index.

Planning Your Home

By E. E. Ericson and Roy L. Soules. Cloth, 131 pages, 7¾ by 11, illustrated. Price, $2. Published by Manual Arts Press, Peoria, Ill.

A book written not so much for the architectural draftsman as for the average student who is interested in home planning. The authors had the following three aims in view: (1) to awaken a desire for better and more beautiful homes; (2) to furnish information which will help the individual to realize his desires when planning his home; (3) to furnish opportunities for actual practice in presenting ideas graphically.

The book discusses home planning under the following nine headings: you and your home; helps in home planning; the use of building materials; styles of domestic architecture; the location of the home; the language of the draftsman; fundamental considerations in planning floor space; analyzing the plan into units; and fundamentals in treating exteriors. It also contains an outline of 25 suggested work units.

The Airplane and Its Engine

By Chatfield, Taylor, and Ober. Cloth, 414 pages, 5⅞ by 8¼, illustrated. Price, $3. Published by McGraw-Hill Book Co., New York, N. Y.

This is the fourth edition of this text which presents the basic principles of the development of the airplane and its power plant. Nothing more than an elementary knowledge of physics and mathematics is required for an understanding of the subject treated in this book.

The book contains 17 chapters which divide up the subject as follows: the essential parts of the airplane; the wing; air-foil modifications and arrangements; parasite drag; stability and control; the airplane engine, general principles; the airplane engine, operating characteristics; the airplane engine, types and details of construction; the propeller, the complete power plant; airplane performance; airplane maneuvers; the airplane structure; the seaplane and the amphibian; the commercial airplane; military airplanes; and aircraft instruments and accessories.

PERSONAL NEWS

♦ R. Randolph Karch, principal of Printing High School, Cincinnati, Ohio, addressed the Ninth District Conference of the International Association of Printing House Craftsmen in Dallas, Tex., April 26. "The Craftsmen's movement," he said, "embraces 6500 far-seeing and progressive printing and litographic foremen and superintendents in all democratic English-speaking countries, and is growing each month. The sole purpose of the organization is to share each other's knowledge. The technical and informative meetings make it outstanding in the field of adult education." The speaker said that this movement will aid executives greatly in the National Defense Program.

Mr. Karch addressed the Dayton, Ohio, Craftsmen and apprentices on April 17 on "How to Get and Hold a Job in Printing."

♦ Hugh J. Betts, supervisor of industrial arts and adult education, Knoxville, Tenn., will present three graduate courses for industrial-arts teachers at the University of Tennessee.

♦ D. E. Everett has been appointed to the office of co-ordinator of the diversified occupations program for Rahway High School, Rahway, N. J.

♦ Harry V. Gilson has been appointed chief of the Resident Center Section of the National Youth Administration. Mr. Gilson will have charge of

(Continued on page 14A)

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The new type of low-cost high quality machine tool — as exemplified by the Delta line — can definitely help solve your vocational training problems because:

First: You can equip your shop for almost 70% less money when you use Delta machine tools instead of heavy mill-type machinery — or you can equip your shop to handle nearly three times as many pupils for the same investment!

Second: They are the same tools that your pupils will most likely use after they graduate . . . whether they go into industry or work with machines as a hobby. Delta machines are replacing old fashioned mill equipment in the industrial field just as rapidly as in the school field.

Third: Delta tools have been found splendid in defense training classes everywhere — in trade schools, refresher courses, C. C. C. and N. Y. A. classes — as well as in the regular vocational educational programs.

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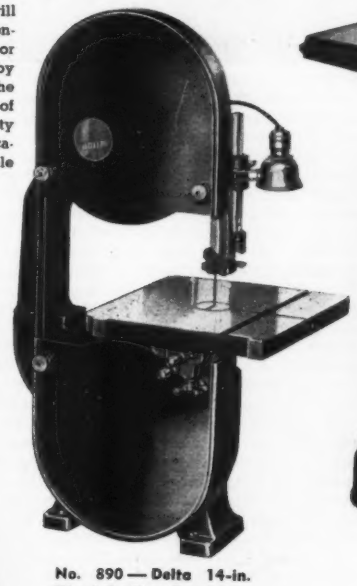

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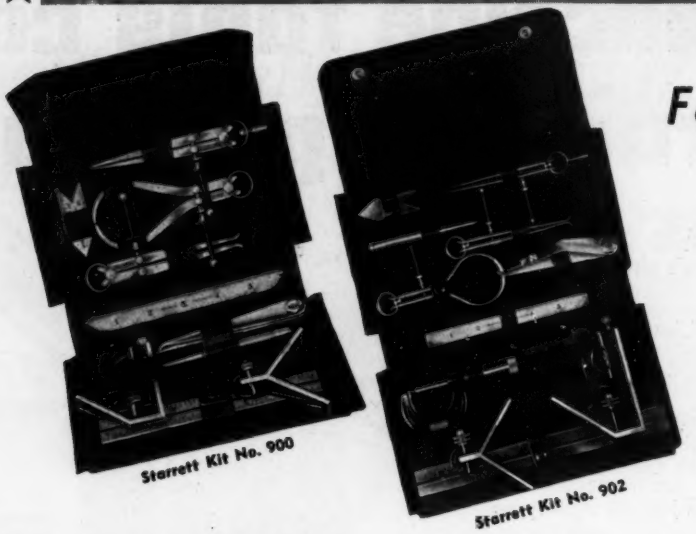

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Precision Tools . . . Dial Indicators . . . Ground Flat Stock . . . . . Hacksaws . . . Metal Cutting Bandsaws . . . Steel Tapes

Standardize on

(Continued from page 12A)

N.Y.A. resident work centers, of which there are now approximately 600 in operation with an employment of about 30,000 young men and women. Approximately 90 additional resident centers with a capacity of 11,000 young people are in the process of being established.

♦ Appointment of ROBERT H. AUGUSTINUS of Portsmouth, N. H., to be State Youth Administrator for New Hampshire, effective May 1, 1941, was announced today by NYA Administrator Aubrey Williams.

Mr. Augustinus will succeed Harold C. Bingham, resigned.

♦ HAROLD BENNETT ADAMS, of Charleston, S. C., has been appointed State Youth Administrator for the National Youth Administration in South Carolina, effective May 1, 1941.

Mr. Adams will succeed Roger L. Coe, resigned. He received his education at a number of colleges and universities including Clemson College and Harvard University, specializing in manual training and industrial education and vocational school administration.

♦ RULON STANLEY HOWELLS, of Salt Lake City, Utah, has been appointed State Youth Administrator for the National Youth Administration in Utah. Mr. Howell succeeds Wilford G. Frischknecht who was recently appointed as Regional Director for the Pacific Coast Region of the National Youth Administration.

ASSOCIATION NEWS

AMERICAN INDUSTRIAL ARTS ASSOCIATION

Another distinctive series of programs, in addition to a notable exhibition, will be sponsored by the American Industrial Arts Association during the meetings of the National Education Association in Boston, Mass., on Monday, June 30, and Tuesday, July 1, 1941.

The exhibition will be of examples of adult handicrafts from all parts of New England. This will be shown throughout the convention at the Society of Arts and Crafts, 32 Newbury Street, Boston. It is being developed for the Association under the direction of Humphrey J. Emery, executive secretary of the society, and through the courtesy of Richard F. Bach, of the Metropolitan Museum of Art; Mrs. Eva W. White, of the Women's Educational and Industrial Union of Boston; Miss Virginia Mack, and Ralph W. Haskell, of the Maine Craft Guild; Mrs. Georgiana Brown Harbeson, of the National Society of New England Women; Daniel J. Sullivan, of the Massachusetts Industrial Arts Society; David R. Campbell, of the New Hampshire League of Arts and Crafts; and many others.

A luncheon developed by Romeo E. Collin, president of the New England Industrial Arts Association, will start the programs on Monday noon at the Hotel Lenox. Dr. William E. Warner, retiring president of the association, will speak on "The Evolving Pattern of Our Profession." Allen D. Backus, national chairman of delegates and affiliates of the association, will make his annual presentation of certificates of affiliation.

Dean Willis B. Anthony, chairman of the department of industrial arts teacher education in the State Teachers College at Fitchburg, Mass., will preside at the afternoon sessions, where Dr. Louis V. Newkirk, president-elect of the association, will give an illustrated address on "Trends of Industrial Arts in Junior and Senior High-School Programs in the Middle West." This will be followed by another illustrated address by Dr. Heber A. Sotzin, chairman of the National Committee on Curriculum of the association, on "Trends of Industrial Arts in Junior and Senior High School Programs on the West Coast." Everett J. McIntosh, vice-president for secondary school programs of the association, and Massachusetts state director of the National Education Association, will summarize.

Through the sponsorship of Epsilon Chapter of Epsilon Pi Tau at Fitchburg, Mass., there will be a fellowship banquet at the University Club on Monday evening, where Dr. Francis T. Spaulding, dean of the graduate school of education at Harvard University, Cambridge, Mass., will speak on "The Role of Industrial Arts in the Program of General Education." The public is invited to hear this noted speaker.

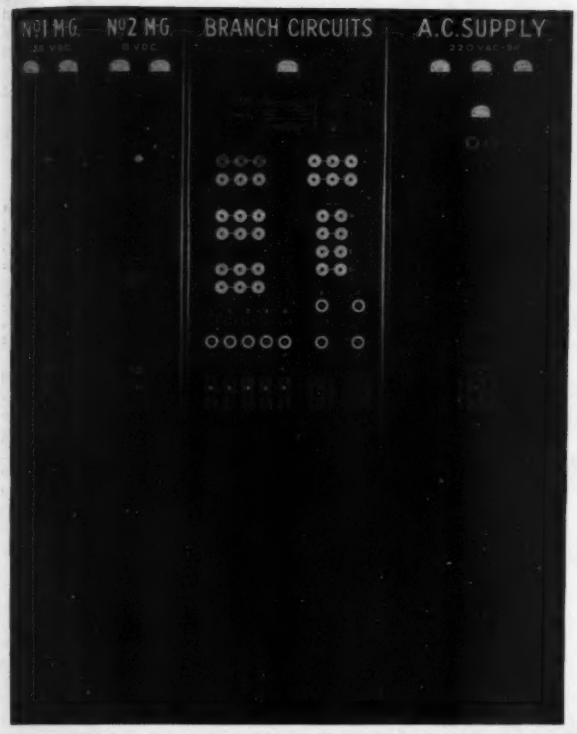
There will be a luncheon conference on Tuesday, July 1, at the Statler Hotel for officers of the American Industrial Arts Association and its affiliates, to consider and project plans of the association. Dr. Louis V. Newkirk will preside.

The most unique phase of the association's series of programs will be a symposium on adult handicrafts, which will be held in the halls of the Boston Society of Arts and Crafts. Mrs. Eva W. White, of the Women's Educational and Industrial Union of Boston, will preside. The speakers will include: Miss Helen E. Cleaves, a director of the department of industrial arts of the Boston schools; David R. Campbell of the New Hampshire League of Arts and Crafts; George C. Greener, director of the North Bennett Street Industrial School; Frank Staples of the National Recreation Association, New York City; and Humphrey J. Emery. The meeting will be summarized by Dr. Frederick J. Moffitt, director of public relations for the New York State Teachers Association, Albany.

Headquarter rooms for members and friends of the association will be maintained during the convention at both the Hotel Lenox and the Statler. — *William E. Warner.*

ANNUAL CONFERENCE ON PRINTING EDUCATION

Three hundred teachers of printing are expected to attend the 20th Annual Conference on Printing Education, under the auspices of the National Graphic Arts Education Association, to be held at the Hollenden Hotel, Cleveland, Ohio, June 29–July 2, 1941. In keeping with the times the program has been built around the general



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theme, "Graphic Arts Education for the Common Defense."

Harry L. Gage, vice-president of the Mergenthaler Linotype Company and chairman of the Advisory Council on Graphic Arts Education will give the keynote address on "The Place of Graphic Arts Education in a Program for Common Defense." At the dinner meeting scheduled for Tuesday evening, July 1, Dr. J. H. Mason, superintendent of public schools, Canton, Ohio, will speak on "Patriotism and Printing Education." George Welp of the International Printing Ink Division of the Interchemical Corporation, New York City, will present a silver cup to the Ottmar Mergenthaler School of Printing for the best printed essay in the recent IPI contest.

Two interesting sessions of the conference will be held at the headquarters of the Cleveland board of education. These will consist of demonstrations of modern instructional facilities and devices in which the school system of Cleveland has taken the leadership.

In addition to the annual conference dinner session there will be two evening sessions. One will be devoted to "Art and Its Relationship to Printing Education" with Alfred Howell, directing supervisor of art, Cleveland public schools, and Otto Ege, professor, Cleveland School of Art, as the main speakers. Two movies will be shown "More Than Meets the Eye," an IPI film and a patriotic film "Youth Marches On," with Arthur E. Ormsbee, Commonwealth Press, Grand Rapids, Mich., narrator, distributed by the Graphic Arts Association of Grand Rapids, Mich.

The other evening session will be the annual meeting of the National Student Graphic Arts Society, the student honor organization of the National Graphic Arts Education Association. This session will be presided over by Harold H. Kirk, Langley Junior High School, Washington, D. C., chairman of the activity.

One complete session will be given over to discussion of the findings of the 1941 research project committee on "Developing Model Courses of Instruction on the Junior, Senior, and Vocational School Levels on a National Basis." This meeting will be in charge of Glen U. Cleeton, head of the Department of Printing, Carnegie Institute of Technology, chairman of the research committee.

Among the other speakers who will take part in the conference program are Dr. Charles H. Lake, superintendent of Cleveland public schools; B. B. Eisenberg, past president, United Typothetae of America; Charles Schraff, president, Cleveland Club of Printing House Craftsmen; Thomas J. Martin, president Cleveland board of education and vice-president of International Typographical Union; Harry A. Porter, vice-president, Harris-Seybold-Potter, Cleveland; Douglas McMurtrie, Ludlow Typograph Company, Chicago, chairman of the educational commission, International Association of Printing House Craftsmen; R. Randolph Karch, principal, Printing High School, Cincinnati, Ohio; A. T. Stavaski, State Teachers College, California, Pa.; J. Henry Holloway, principal, The New York School of Printing, New York City; John E. Fintz, directing principal Special Schools and Vocational Education, Cleveland; Frank C. Moore, director of industrial arts, Cleveland; M. J. Eck, supervisor of printing education, Cleveland, and 20 printing instructors of the Cleveland public school system who will give the special demonstrations of teaching technique.

The general chairman of the conference is Chester A. Lyle, Timken Vocational High School, Canton, Ohio, president of the National Graphic Arts Education Association. The other officers of the association are: Hupp E. Otto, assistant principal, McKinley Trade School, Wheeling, W. Va., vice-president; R. Randolph Karch, principal, Printing High School, Cincinnati, Ohio, secretary; E. S. French, Eastern High School, Washington, D. C., treasurer, and Fred J. Hartman, educational director, Washington, D. C. M. J. Eck of the Cleveland public school system is the local chairman on conference arrangements.

A commercial exhibit of printing school equipment and supplies is being planned.

1941 PENNSYLVANIA INDUSTRIAL ARTS CONFERENCE

The first all-Pennsylvania Industrial Arts Conference was held Saturday, April 26, on the campus at Millersville State Teachers College, Millersville, Pa. About 900 persons attended.

Urwin Rowntree, chief of the bureau of industrial education, Pennsylvania State Department of Public Instruction, presided at the morning session.

Dr. Allen Eaton, survey agent of the Russell Sage Foundation, spoke on "American Handicrafts." Dr. Eaton, besides being affiliated with The American Federation of Art, was a former member of the faculty of the University of Oregon. He is also the author of several books, the best known being, *Handicrafts of the Southern Highlands*. He illustrated his talk with exhibits from various sections of the United States.

Dr. Eaton summarized the values of handicrafts to be economic, social, educational, aesthetic, and therapeutic. His prophecy was that in the future we will judge other people's work by a double measure; that is, not only how well it conforms to our own ideas, but also what it has meant to the person who made it. Finally, everyone was encouraged to develop those hidden potentialities and to help others to do the same.

At the luncheon, following the morning program, William Caswell, supervisor of industrial arts at Mansfield State Teachers College, was toastmaster.

Elroy Bollinger, supervisor of industrial teacher education in New York City, addressed the group on "Problems of Industrial Arts Teaching."

In his talk, Bollinger stated that the industrial-arts teacher should be technically competent with a natural interest in his field. The instructor should possess desirable personal qualities and exemplary precepts. Also, the major interest should center about the student and not on the subject taught; that is, he owes his allegiance to youth and not to the particular phase of activity which he enjoys most himself.

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The teacher should affiliate himself with professional organizations for his improvement and should participate in all forms of professional activity so long as they do not interfere with the occupation for which he is hired. In addition, no teacher should pledge his allegiance to any type of activity that differs from the training of youth or that takes him away from actual teaching experience.

He challenged each to constantly improve himself technically and professionally. His advice to the undergraduates and beginning teachers was to acquire the necessary background of actual experience before going on professionally with advanced training. In concluding he remarked, "Industrial arts is only as good as the teachers we have in it."

The following off-campus guests were included at the speakers table: Dr. Walter Jones, University of Pennsylvania; Charles Zinn, Pennsylvania State College; Dr. C. Valentine Kirby, state director of art education; Dr. Theodore Sieddle, dean of instruction at California State Teachers College; Itallio DeFrancesco, director of art at Kutztown State Teachers College; Messrs. Ralph Wenrich, Robert Stoner, and Kenneth Cornwell, state supervisors of industrial arts; George Bordelais, superintendent of engineering shops at Swarthmore College; S. L. Coover, director of industrial arts at California State Teachers College; Miss Rose Leacock, art director, California State Teachers College.

In the evening the Iota Lambda Sigma Fraternity banquet and the formal initiation ceremonies were held. At that time five undergraduates were received into membership, and Elroy Bollinger became an honorary member. At the banquet and initiation were representatives of Alpha Chapter, Pennsylvania State College; Theta Chapter, University of Pittsburgh; Nu Chapter, University of Maryland, and Iota Chapter of Millersville State Teachers College.

Also, at the conference, at various campus locations, were exhibits from representatives of 45 firms that manufacture and distribute industrial-arts materials. In the morning there was continuous showing of sound motion pictures concerning occupational guidance; part of a series known as, "Your Life Work Films."

THE INDIANA INDUSTRIAL EDUCATION ASSOCIATION CONVENTION

The Indiana Industrial Education Association held its tenth annual convention at the Memorial Union Building, Purdue University, Lafayette, Ind., March 28 and 29, 1941. The convention was very successful in many ways.

At the administrator's luncheon meeting Dr. H. B. Allman, superintendent of schools, Muncie, Ind., spoke on "Future Administrative Problems of Industrial Education."

The afternoon speakers were Dr. E. Lowell Kelly, division of education and applied psychology, Purdue University, who spoke on the "Mechanic As a Researcher." The outstanding speaker of the convention was Dr. Walter C. Eells, Executive Secretary, American Association of Junior Colleges, Washington, D. C., who spoke on the problems of the junior college and its place with reference to vocational education. Mr. Eells spoke at the Friday afternoon session and the Saturday noon luncheon.

At the annual banquet, President Elliott, of Purdue University, acted as toastmaster. At this meeting Dr. A. W. Cordier, head of history and political science department of Manchester College, spoke on "Mental Attitudes Are a Factor in the Present European Situation." Dr. Cordier, has made five trips to Europe since 1929 and was closely associated with the work of the League of Nations. He declared that the people of Italy generally were not pro-Nazi, although Mussolini and other Fascist leaders had pledged aid to the axis cause. He expressed the opinion that France was demoralized because the people had no common interest about which they could rally.

The breakfast on Saturday morning was sponsored by the Epsilon Pi Tau and Iota Lambda Sigma fraternities. The speaker at this occasion was Carl Hamburger, assistant director of industrial arts, Cleveland, Ohio, who spoke on the industrial arts in the elementary grades.

Sectional meetings were held Saturday morning in which many interesting talks and practical ideas were exchanged. This was followed by the business meeting, at which time Virgil Fleenor, who had been vice-president for the past year was advanced to the presidency and Fred J. Schmidt, associate professor of industrial arts, Ball State Teachers College, Muncie, Ind., was elected vice-president. H. G. McComb is permanent secretary of the association.

At the Saturday luncheon, which was presided over by Marvel Moore, president of the association for the past year, Dr. Eells pointed out the fact that the junior colleges do have a definite place in the life of our boys and girls today. With the problem of age limit and the early graduation from high school affecting their entrance into gainful employment, it is fitting that the junior college enter into the picture. It equips the student to enter business and industries with a better background and greater productivity from the employer's standpoint.

The meeting place of next year's convention and date has not been set at this time.— *Marvel Moore.*

♦ The Industrial Education Club of the University of Maryland, after two years of constructive growth, was installed as the NU Chapter of Iota Lambda Sigma, national professional industrial-education fraternity, on April 5, 1941. Seventy-one members of the club were initiated during the ceremonies held in Baltimore, Md. Undergraduates, graduate students, and graduates engaged in industrial-arts and industrial-vocational education in Maryland, Virginia, and the District of Columbia, were among the initiates.

(Continued on page 18A)

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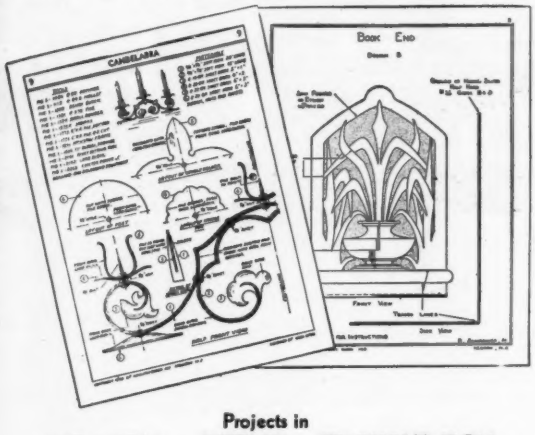

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The course is in two parts consisting of Instructors Key Sheets giving the correct fitting numbers for all required materials, and separate student's job assignments which are printed on a special thin paper which may be given to the students for blueprint reproduction.

Since this course represents a considerable investment of time and money, and since it is desired to distribute it only to schools and instructors, a nominal price of $2.50 per copy has been placed upon the complete course. However, initial distribution to schools and instructors will be made free of charge when requested upon school letterheads or other suitable identification is given. We are sure you will find this material interesting and useful. It is offered to you as further expression of the Wiremold Company's desire to be of genuine service.

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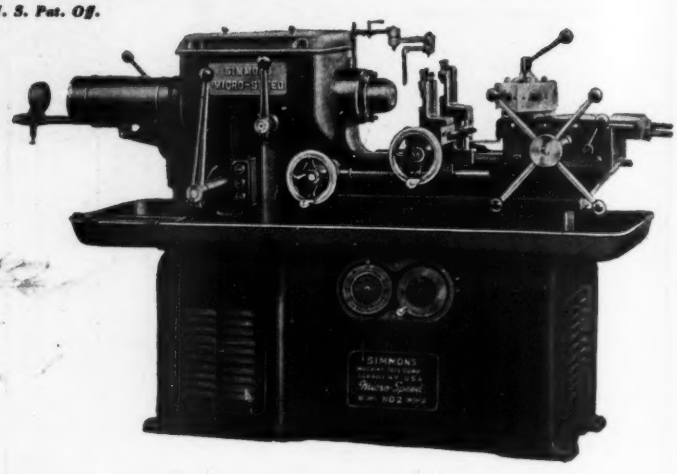

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(Continued from page 16A)

The ceremonies were in charge of the Iota Chapter, Millersville State Teachers College, Edwin Summer, president. Ward Yorks as master of crafts with a degree team of 15 conducted the formal initiation.

Prof. Glen D. Brown, head of the industrial education department of the University of Maryland, was toastmaster at the banquet which followed. The university was officially represented by Dr. Arnold E. Joyal, acting dean of the College of Education. Dr. Harold C. Hand, professor of education, University of Maryland gave an address on "The Outlook and Work of the National Commission on Resources and Education." He is an active member of this commission.

The charter was presented by Prof. E. E. Howard, past president of the fraternity, and the response for the NU Chapter was given by James L. Reid, president elect. The Grand Chapter was also represented by George H. Resides, secretary-treasurer, of Pennsylvania State College, and F. Theodore Struck, Federal Office of Education, one of the founders of the fraternity. Other members present were Charles W. Sylvester, director of vocational education, Baltimore, and John J. Seidel, assistant superintendent Maryland Department of Education. William Maza, secretary-treasurer Iota Chapter, introduced the members of the initiating team.

The officers of the local group are: James L. Reid, president; Arthur M. Hubbard, vice-president; Howard E. Ziefle, second vice-president; Charles W. Dudderar, treasurer; Clarence M. Shepherd, secretary; Glen D. Brown, faculty sponsor. Edward L. Longley was chairman of the Committee on Arrangements, and John J. Grimes was chairman of the Program Committee.

With the addition of the University of Maryland chapter, Iota Lambda Sigma now has 13 chapters in leading universities which administer

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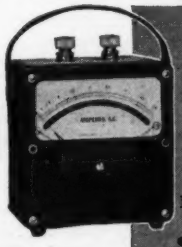

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The Milwaukee Industrial-Arts Teachers Association inspecting the Yates-American plant

a program of industrial education. These are ALPHA, The Pennsylvania State College; BETA, University of Tennessee; GAMMA, Clemson College; DELTA, University of Akron; EPSILON, University of Alabama; ZETA, Oklahoma A & M College; ETA, Colorado State College; THETA, University of Pittsburgh; IOTA, Millersville State Teachers College; KAPPA, University of Florida; LAMBDA, Mississippi State College; MU, Purdue University; and NU, University of Maryland.—*Clarence M. Shepherd.*

♦ The following officers were elected at the Easter convention of the Texas Vocational Association held at Temple, Tex.: president, S. V. Burks, Kingsville; vice-president (homemaking), Miss Lenora Walters, Houston; vice-president (industrial education), W. E. Wright, Dallas; and vice-president (rehabilitation), O. L. Wiley, Houston.

♦ The Industrial Arts Teachers Association of Milwaukee, Wis., recently visited Beloit, Wis., where they inspected the plants of the Fairbanks-Morse Co., manufacturers of Diesel engines; and the Yates-American Machine Co., well-known manufacturers of woodworking machinery.

The Yates-American Machine Co. served the group with a luncheon and all participants were lavish in their praise of the value of the two shop visits which they had made.

ROCKFORD ILLINOIS CONVENTION

The Illinois Vocational Association met March 27, 28, and 29, 1941, in Rockford, Ill., under the leadership of President James M. Thompson, head of commercial department, Eastern Illinois State Teachers College, Charleston, Ill.

The Illinois Vocational Association has the largest membership of any state association and is composed of the industrial education teachers, vocational homemaking teachers, agriculture teachers, commercial teachers, and art teachers. These five groups are affiliated together and work for the best interests of practical arts and vocational education in Illinois.

The meeting in Rockford was well attended and brought before the teachers and administrators of Illinois many valuable general and sectional meetings. Rockford is a progressive city of 85,000 people located in the picturesque Rock River section of northern Illinois.

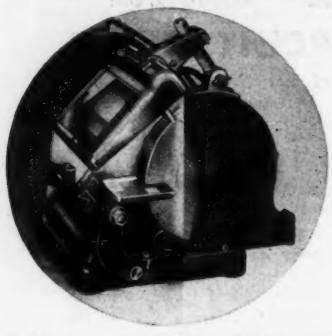
Outstanding among the speakers on the general and sectional programs were: Dean M. Schweickhard, assistant superintendent of Minneapolis; Governor Dwight H. Green of Illinois; Walter Ingram of Kiwanis International; James Watson, training director for Montgomery Ward and Company; Dr. Paul B. Jacobson, principal of the University of Chicago High School; and

(Continued on page 20A, third column)

SHOP EQUIPMENT NEWS
New Products—Publications

NEW STANLEY "FLUD-LITE" EYE SHIELDS

A new Flud-Lite eye shield suitable for use on all grinders, belt or motor driven, is announced by Stanley Electric Tool Division, New Britain, Conn. Fitted with two bayonet-type light bulbs it throws light directly on grinding wheel and work. The design and lighting arrangement provides 30 per cent more visibility for the operator than previous models. The eye shield is adjustable up or down and can be arranged to suit the operator's position. It cannot, however,



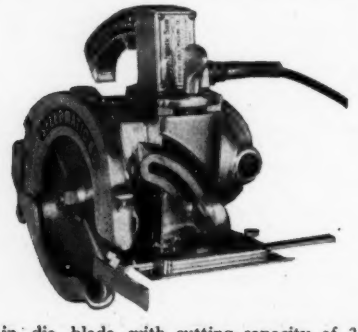
be moved to a nonguarding position without dismantling. Eye protection is of paramount importance. Students in schools should not be exposed to the hazards of flying particles from grinders not equipped with suitable eye shields. These shields are more sanitary than goggles, and being attached to the grinder, must be used. The features of this new Stanley "Flud-Lite" shield make it particularly suitable for use in school shops.

The frame is a sturdy die casting, aluminum finish, and holds two sheets of 4 by 6-in. glass, one piece safety glass with ordinary window glass beneath. This permits the lower glass to be replaced if it becomes pitted with emery dust. The two bayonet-type bulbs are made with a supported filament to withstand vibration. The eye shield can be wired so that the lights come on when grinder switch is operated on any grinders with 115- or 220-volt motors. A reflector, mounted behind light bulbs, floodlights work and wheel. "Flud-Lite" eye shields are easy to attach.

No. 600 "Flud-Lite" eye shield comes complete with two light bulbs, bolts, and instructions for mounting and connecting.

LIGHTWEIGHT, HIGH-SPEED, ELECTRIC HANDSAW

The Porter-Cable Machine Co., Syracuse, N. Y., announces another addition to their line of Speedmatic saws. This new machine carries a



6½-in. dia. blade, with cutting capacity of 2-in. material, yet weighs only 15½ lb. The blade travels at 7200 r.p.m., producing a cutting-edge speed in excess of two miles a minute.

Through the use of the helical cut gear drive in this tool, 98 per cent of the motor power is transmitted to the drive shaft in comparison with the usual 76 per cent delivered in worm-gear driven high-speed saws.

This model is designated as Type K-65. It is perfectly balanced and equipped with a ⅝ h.p. Universal motor. The base raises and lowers for depth adjustment, and tilts to 45 deg. for bevels. A cast-in and enameled graduated scale affords quick and accurate setting.

NEW STEEL STOOLS

New on the market this month is the complete line of Steel Stools being introduced by Lyon Metal Products, Inc., Aurora, Ill. The new line includes seven heights, from 18 in. to 30 in. in multiples of two inches, and there are 112 models available.

The models are built around an all-welded basic stool with forged steel, dome-shaped feet, and steel seat. To this stool may be added a pressed-wood seat, adjustable steel back, rubber feet, or rubber feet with steel glides, or casters.

Important Lyon features are the all-welded, non-breakable construction; unusually large seat area; strong channel-brace footrest a uniform distance below seat on all heights; round edge, steel-band construction with no rough edges to snag or tear clothing; tapered legs that insure safety against tipping; and all accessories are interchangeable and may be attached at any time.

Complete information on stools and other steel shop equipment may be found in the new Lyon Bulletin No. 331.

SPATTER-RESISTING WELDING CLAMP

J. H. Williams & Co., 225 Lafayette St., New York City, are now offering a special Spatter-Resisting finish on their drop-forged "C" Clamp

which resists the adherence of welding spatter to the body, swivel, and screw. These completely cadmium-plated clamps are available in seven sizes, with capacity opening range from 2 to 12 in.

(Continued from page 19A)

Lester J. Schloerb, director occupational research, Chicago public schools.

Governor Dwight H. Green spoke on "Illinois Preparedness in National Defense." Governor Green spoke before an overflow crowd in the grand ballroom of Hotel Faust and the address was broadcast. Preparedness and national defense were outstanding themes throughout the three-day convention.

President H. P. Harshbarger, of the I.I.E.A. division, and vice-presidents Milo T. Oakland and Robert Shumway organized an excellent educational program in industrial arts and industrial education which included trips to industry, a luncheon, and section meetings on guidance, trade and industrial education, automotives, crafts and ceramics, drafting, electromechanics, general shop, graphic arts, machine shop and metals, and woods.

Paul E. Harrison of Northern Illinois State Teachers College served as chairman of the industrial-arts luncheon. Dean M. Schweickhard gave a fine address on "State Meetings and Associations" and Orville A. Oakes, of New Trier Township High School, Winnetka, Ill., gave an excellent illustrated lecture on "Hawaii in Color."

Excellent commercial and educational exhibits were attractively displayed in the Faust hotel. The educational and commercial exhibits are always high lights at I.V.A. conventions and the teachers and administrators have an opportunity to discuss problems and examine the latest developments in equipment and instructional materials.

The I.V.A. banquet was held in the grand ballroom of the Faust hotel and was one of the high lights of the convention.

Dr. R. G. Fraiser, research specialist, Board for Vocational Education, State of Iowa, gave a fine address on "In the Defense of Democracy." David Schoonmaker, principal, Washington Junior High School, Rockford, served as toastmaster. Superintendent Selmer H. Berg of Rockford introduced the guests. Deck officer John Claude, of the Bruce Publishing Co., presented the ships prizes. Quinn Bowen and his dance band took over after the dinner program.

Robert Shumway, head industrial-education department in Rockford and local chairman of the convention, did a fine job of convention planning with his local groups. Dr. William H. Johnson, superintendent of Chicago schools was elected president of the I.I.E.A. for 1941–42 and Kenyon S. Fletcher was elected treasurer of the I.I.E.A.

The 1942 convention will be held in Chicago.

♦ The sixth annual convention of the Wisconsin Association for Vocational and Adult Education, held at Milwaukee, Wis., May 1, 2, and 3, was an outstanding success.

The officers of the association, and the efficient local committees deserve much credit for the smooth and capable conduct of the entire convention.

The industrial and educational tours arranged for Thursday and Friday were well chosen and excellently patronized.

The general meeting on Friday morning under the chairmanship of John A. Kubiak, president of the Wisconsin Association for Vocational and Adult Education, was attended by a record-breaking audience.

Willis Sutton, superintendent of schools, Atlanta, Ga., who spoke on "The Great American Imperatives," emphasized that the children must be taught to love the soil on which we live and from which we get our sustenance; to learn reverence for the home; respect human life; and that it is high time that we again acquire a love for beauty and to revive in all the faith of our fathers in a personal God.

Dr. R. H. Woods, state director of vocational education, Frankfort, Ky., in his address, "Why I Believe in Vocational Education," pointed out that while the vocational aim in education is not the only one, nevertheless, it is a significant one. The present time requires skilled workers, not merely workers.

Vocational education gives individuals the

(Continued on page 22A)

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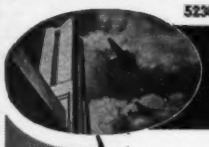

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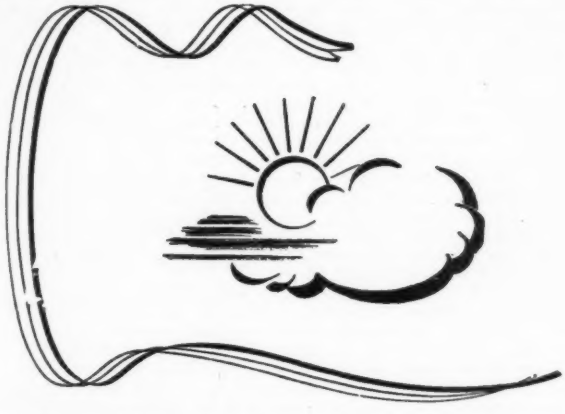

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(Continued from page 20A)

opportunity of acquiring skills, and that those privileged to teach in vocational schools are confronted with a tremendous task if the American way of life is to be perpetuated.

The banquet held on Friday evening was equally well attended. The chairman on this occasion was Dr. William F. Rasche, director of the Milwaukee Vocational School. James E. Gheen, well-known after-dinner speaker, couched many solid truths in humorous guise in his address entitled, "Do You Want What You Need?"

The Saturday morning session, under the chairmanship of John F. Jones, first vice-president, was equally well attended. Dr. Abram L. Sachar, national director of the Hillel Foundations, University of Illinois, gave a scholarly address on this occasion, which touched on many of the questions which are troubling the world today.

Numerous sectional meetings for those interested in agriculture, attendance work, commercial subjects, co-ordination, distributive occupations, general subjects, homemaking, national youth administration, rehabilitation, trades and industry, automotive service, electricity, drafting, machine shop and welding, printing, sheet metal, and woodworking trades also were held.

An Epsilon Pi Tau breakfast was held Saturday morning. Clyde A. Bowman, dean, School of Education, The Stout Institute, Menomonie, Wis., was the chairman.

At the business meeting held Saturday morning, the following officers were elected for the coming year: president, John A. Kubiak, Madison; secretary-treasurer, William A. Brazier, Milwaukee; vice-presidents, Jess S. Smith, Lake Geneva (agriculture); C. D. Rejahl, Beloit (rehabilitation); and Jacob Van Kooy, Milwaukee (trade and industry).

The "Skiff" program closed the 1941 convention. The location for holding the Wisconsin Association for Vocational and Adult Education convention next year will be decided upon at a later date.

♦ The printing teachers of New Jersey with the members of the New York Printing Teachers Guild as guests, held their Annual Convention of the New Jersey Vocational and Arts Association at the Berkeley-Carteret Hotel, Asbury Park, N. J., on March 29.

George D. Deane, printing instructor, Essex County Boys Vocational School, Newark, the presiding officer, introduced Chester A. Lyle, president of the National Association, as the first speaker. David Greelis, field representative of the U. S. Dept. of Labor, Washington, D. C., led an interesting discussion on the new developments in apprentice training sponsored by the government. Howard N. King, typographic counselor, Intertype Corp., gave the final address on "Typography That Sells Merchandise."

♦ At the eighth Conference on Business Education to be held at the University of Chicago on June 26 and 27, 1941, the following topics will be discussed, "What the New Economic Education Is," "Concepts v. Verbiage in Economic Education," "Possibilities and Limitations of the New Economic Education," "Obligations of the Public School in Economic Education," "Unbiased Economics in the Public Schools," "The New Economic Education and the Teacher," "The Individual in His Immediate Economic Relationships," "Impersonal Economic Stresses and the Individual," and "The New Economic Education and Individual Adjustment."

A symposium, in which the materials for the new economic education will be discussed from the viewpoint of the elementary, junior high, senior high, and the junior college, will also be presented.

The chairmen for the various sessions are: G. H. Brown, instructor in marketing, University of Chicago; Emery T. Filbey, vice-president, University of Chicago; R. S. Barnes, Waukegan Twp. Secondary School, Waukegan, Ill.; and Miss Jessie Graham, Los Angeles Public Schools, Los Angeles, Calif.

♦ The South Eastern Wisconsin Industrial Arts Conference was held on March 29 at Cudahy, Wis., at the Cudahy High School. Louis F. Barocci presided.

John E. Jones, superintendent of schools, Cudahy, welcomed the guests. Frank V. Powell, assistant state superintendent of public instruction, Madison, Wis., chose for the title of his address, "In the Midst of Danger."

R. R. Bedker, president of the Wisconsin Industrial Arts Association, reported on association activities.

John J. Metz, editor, INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazine, spoke on "Industrial Education and the Needs of Today."

G. VonGonten of South Milwaukee High School, gave an address on plastics.

Bernard E. Hogue, principal, Cudahy High School, discussed, "Consumer Education Through Industrial Arts."

H. E. Merritt, supervisor secondary schools, state of Wisconsin, spoke on "Industrial Arts and General Education."

Dr. William F. Rasche, director, Milwaukee Vocational School, chose, "The Responsibility of Educators in Preparing Youth for Industrial Employment" for the title of his address.

At the luncheon, O. D. Eicher, employment manager, Ladish Drop Forge Co., Cudahy, spoke on the drop-forging industry. Inspection tours to the Ladish Drop Forge Plant and the Modern Machine Works Plant were scheduled for the afternoon.

♦ The April meeting of the Westchester Industrial Arts Club, held at the Bronxville high school, Bronxville, N. Y., was in the form of a "Manufacturers' Night" in which more than 25 firms exhibited and demonstrated machines, tools, equipment, materials, and processes closely related to the field of industrial arts. In addition to the demonstrations put on by the participating firms Mr. Schulte, a Bronxville metal-craftsman of international reputation, and Emerson W. Manzer of the club, gave demonstrations of repoussé and metal spinning respectively. The evening was arranged by Mr. Manzer, chairman, and his committee which consisted of the following: Kenneth Horton, Bronxville; Ludwig Kasal, Mount Vernon; Roland Hintz, New Rochelle; Carl Hubacheck, New Rochelle. Men from the Long Island, Orange County, and Fairfield (Conn.) industrial-arts clubs were present at the invitation of the Westchester shopmen.

The banquet committee reported that the annual banquet, which is the club's "Ladies' Night" and also the occasion for the installation of the next year's officers, is to be held at Mayer's Parkway Restaurant, Bronx, New York City, on Saturday evening, May 24. The committee in charge of this affair is as follows: Francis Delaney, chairman, of Tuckahoe; Orville Hayford, Tarrytown; Oliver Kendall, Mount Vernon; Harry Kabel, Children's Village, Dobbs Ferry.

It was also reported that Wilbur Robinson, a charter member of the club, is still confined to his bed in the Lawrence Hospital, Bronxville, N. Y. May all his friends who read this item, whether they be in New York or some other state, take the time to send him a card which we are sure will be appreciated by our good friend and ardent industrial-arts booster, "Robbie." — *Herbert F. Lidstrom.*

♦ The March meeting of the Industrial Arts Instructors of Worcester County, Md., was held at Ocean City on March 15.

At this meeting a continued revision of the county course of study of the general shop was directed to the completion of the unit in electricity. The group then began on the woodwork unit. This unit was completed at the meeting on April 5 at the same place.

During the April 5 meeting, the members commenced work on the last unit for this year, metalwork. This unit was divided into art metal, sheet metal, and cold metal.

This unit is to be finished at the next meeting, April 26. The superintendent of schools for Worcester County is to be there to criticize the work.

(Continued on page 25A)

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(Continued from page 22A)

The members of the club are: John T. Bruehl, Jr, Berlin; Robert J. Johnson, Ocean City; Gerhardt Neubauer, Pocomoke City; and Vernon Patz, Snow Hill. — *John T. Bruehl, Jr.*

♦ The Kentucky State Industrial Arts Association met as a regular section of the Kentucky Education Association in Louisville, Ky., April 18.

At noon all those present assembled in the Colonel's Room of the Kentucky Hotel for a luncheon. After the luncheon, David M. Wherry, president of the association introduced Dr. M. Keith Humble, co-ordinator of defense training, state of Illinois, who acted as chairman during the discussion upon the topic, "What Can An Industrial Arts Program Contribute to National Defense?" Those who took part in the panel discussion besides Dr. Humble were Harold G. Wilson, supervisor, trade and industrial education, state of Kentucky; Charles Youmans, co-ordinator of defense training, Lexington, Ky.; L. T. Smith, head of industrial arts department and NYA supervisor, Western Kentucky State Teachers College; and Leonard Daugherty, supervisor of industrial arts, Louisville.

After the regular discussion of the topic by the panel members, questions pertaining to the subject were advanced by persons in the audience and answered by the panel members.

The officers elected for the coming year are: H. L. Oakley, Lexington, president; Edwin B. Hundley, Louisville, vice-president; Edgar Mara, Covington, secretary-treasurer; D. P. Denison, Greenville, and David M. Wherry, Dayton, committee members. — *Edgar Mara.*

NEWS NOTES

♦ The National Youth Administration had 585 new workshops and 89 resident centers under construction on March 1 which when completed will provide additional facilities for giving young people work experience and related training for defense jobs.

A progress report on the NYA construction program shows that on March 1 there were 274 farm-shop buildings being built. When completed these structures will be turned over to the local school systems which will equip and operate them to provide shop training to young people from rural areas.

In addition there were 311 other workshop buildings under construction as of March 1. These facilities will be used by the NYA to provide out-of-school youth with practical work experience, and related training through the co-operation of the local school systems. The National Youth Administration does not itself undertake classroom training but relies on the local school systems to provide instruction in both academic and vocational subjects for young people employed on its out-of-school work program.

There were 89 new resident centers under construction on March 1 which will provide both working and living facilities for out-of-school youth. At present there are approximately 600 resident centers in operation which are providing more than 36,000 young men and young women with basic experience in shop- and mechanical-production work.

♦ Qualified persons are urged to file at once their applications with the United States Civil Service Commission, Washington, D. C., for positions as regional and special agents in trade and industrial education. The examination held last fall failed to produce enough eligibles to fill the positions open in the Office of Education of the Federal Security Agency. The maximum age limit has been raised to 60 years. The position of regional agent pays $4,600 a year, that of special agent, $3,800 a year. A written test will not be given but competitors will be rated on their education and experience.

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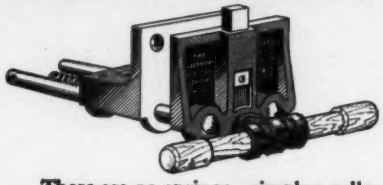

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Date of examination will be announced later.

♦ An examination for positions as training specialist, paying from $3,200 to $5,600 a year, has been announced by the United States Civil Service Commission. Separate employment lists will be set up according to the types of training work for which eligibles are qualified. Training specialists will plan, organize, and direct training programs for a variety of technical and professional personnel in major departments of the government. They will act as consultants to operating departments in matters of training procedures and policy, and will adapt and devise training methods and materials.

Responsible experience in organizing, developing, and administering programs for training employees in industry, business, or government is required. Applicants must have demonstrated their ability to use a variety of techniques and training methods, and must show a thorough knowledge of at least one field in which they have organized and administered a training program. In addition to this experience, completion of either a four-year college course or four years of additional experience is required.

Applications must be on file at the Commission's Washington office not later than May 28, 1941. Further information and application forms may be obtained at any first- or second-class post office or from the Civil Service Commission, Washington, D. C.

♦ The University of Tennessee, Knoxville, is offering summer school courses for industrial-arts teachers in mechanical drawing, woodwork, sheet metal, and electricity. The graduate courses offered will be in methods of organizing and teaching general shop, special methods in industrial-arts teaching, and administration and supervision of industrial arts.

♦ An educational experiment, designed to supply more aeronautical engineers quickly and also to upgrade others into aircraft specialists, is progressing well at two Maryland universities, it was revealed recently by the Glenn L. Martin Co., cosponsor with the National Defense Council.

Courses at the University of Maryland are turning mechanical, civil, and other classes of engineers into aeronautical experts and refreshing former engineers. Other courses are giving practicing aeronautical engineers advanced training for increased responsibilities. Still others are preparing men to be tool designers and aircraft inspectors.

At the Johns Hopkins University, qualified engineers are being given intensive instruction in highly specialized subjects, such as electricity as applied to aircraft, plastics, fluid mechanics, and cabin supercharging, heating and ventilating. Others are being trained in factory management and time-and-motion studies to create a supply of production technicians.

It is to supply the need of the Martin Co. for aeronautical and tool-design engineers, inspectors, and technical experts, that these programs have been instituted in the two universities, using defense funds.

♦ Twenty new courses relating to the National Defense Program, ranging from how to fly an airplane to studies of wartime price policies, will be offered in the summer quarter at the University of Chicago.

The summer session, divided into two terms, marks the fiftieth anniversary year of the institution which fathered the summer quarter. More than 600 courses and 12 special institutes and conferences under the guidance of 450 faculty members will be offered. Registration for the first term opens June 21.

Featuring a week-end program utilizing the University's 480-acre Mill Road Farm estate, courses in basic military training, techniques of warfare, map reading, and field strategy are included on the summer schedule of the University's Institute of Military Studies. Also embraced in the Institute are refresher courses for reserve officers, and preconditioning courses for potential draftees.

♦ The National Society for the Prevention of Blindness has announced that it is cooperating with the following colleges and universities in offering, at their 1941 summer sessions, courses for the preparation of teachers and supervisors of sight-saving courses:

Wayne University, Detroit, Mich., (elementary course). June 23 to August 2. Director of the course: Margaret Soares, supervisor of Braille and Sight-Saving Classes, Detroit.

Western Reserve University, Cleveland, Ohio, (advanced course). June 23 to August 2. Director of the course: Olive S. Peck, supervisor of Braille and Sight-Saving Classes, Cleveland public schools.

State Teachers College, Buffalo, N. Y. (advanced course). July 7 to August 15. Director of the course: Mrs. Winifred Hathaway, associate director, National Society for the Prevention of Blindness, 1790 Broadway, New York, N. Y.

Details regarding the courses may be obtained from the university or college, or from the director in charge of the course.

♦ Bramwell High School, Bramwell, W. Va., is bringing to a close its first year of industrial arts. A National Defense Training school has also been under way since the first of February, thus utilizing the school's new equipment as well as additional equipment furnished by the government.

An Evaluation of the Unit-Directed Study Procedure

By Robert Scott Ellwood. This study was made relative to the success of attaining certain modern history objectives by the unit-directed study procedure as contrasted by the recitation method. Illinois State Normal University, Normal, Ill.

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